Fenner Drives®
Precision Products Division
An ISO 9001:2000 certified company

Fenner Drives Precision Drive Components

TECHNICAL INFORMATION

Fenner Drives®

Precision Products Division

An ISO 9001:2000 certified company

Fenner Drives — A Global Company

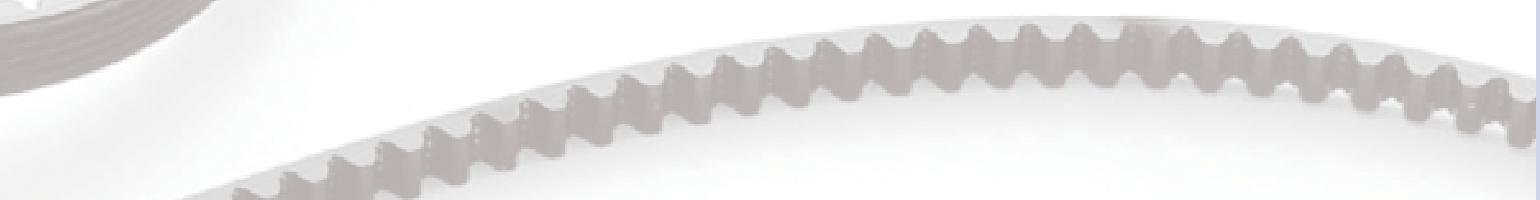
An Industry Leader in Precision Urethane Belting

Our mission is to be the preferred, worldwide OEM supplier of precision belt drive systems for power transmission, motion control, and transfer applications.

For three decades, our continued investments in personnel, capital expansion, and advanced materials have delivered leading edge urethane belting technology. We are dedicated to achieving our mission by providing our customers with not only the best product, but the best manufacturing process and customer support in the industry.

These investments, which include a state-of-the-art manufacturing plant located in Manheim, Pennsylvania, provide Fenner Precision with the resources necessary to fully accommodate your requirements. By working closely together during project inception, we will help you choose the optimal materials and profiles for your belt drive design. We can reduce your product introduction cycle by utilizing our modern laboratory and accelerated test facilities.

In order to address the growing demand for standard, light-duty timing belts, we have developed a new program to respond quickly to your needs. Look for the icon throughout the manual, which references those items that are part of this program. Let Fenner Precision apply our many years of material, product and application knowledge to your project...with *speed* and *efficiency*!



At Fenner Precision, we are dedicated to being the leading manufacturer of precision urethane belts. Our new technical manual is a statement of that commitment. This manual* guides you through the belt selection and sizing process, and offers solutions for common belt design problems. For unique applications, technical support is available from our knowledgeable engineering and sales staff.

Note: Standard belts are *not* intended for use on aircraft systems or in life-support applications. Please contact Fenner Precision for special design considerations.

* The information presented herein is for reference only and may change without notice.

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Fig. 1

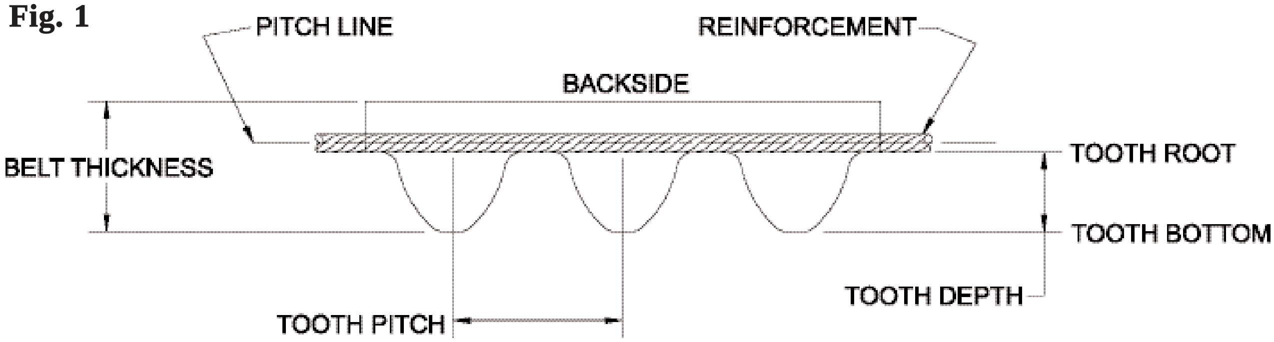
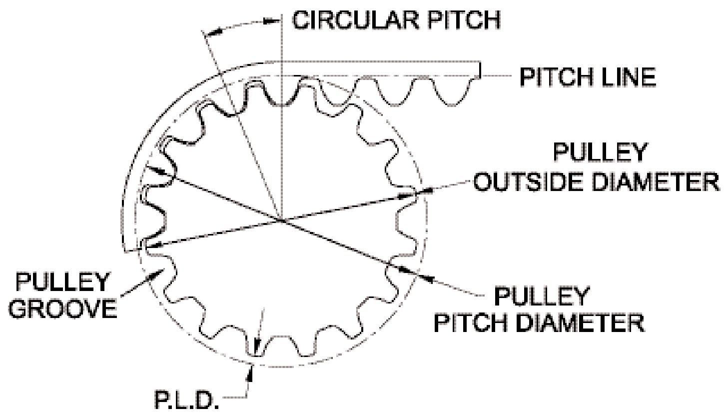


Fig. 2



Tooth Pitch – The distance between two adjacent tooth centers as measured on the pitch line of the belt.

Pitch Line – The neutral axis of the belt. In a timing belt it is the center of the reinforcement. The pitch diameter of the pulley and the pitch line of the belt must coincide. See Tooth Configurations on page 17 to determine the proper pitch line locations for your applications.

Pitch Line Differential (P.L.D.) – The perpendicular distance from the pulley outside diameter to the pitch line. On the belt, it is the distance from the tooth root to the pitch line.

Tooth Depth – The distance from the tooth bottom to the tooth root (measurement does not include the cord support).

Pitch Length – The total length of the belt when measured along the pitch line.

Reinforcement – The tensile load bearing member of a timing belt. It is responsible for providing the tensile strength of the belt.

Cord Support – Belt feature which locates the reinforcement at the pitch line (See page 17).

Belt Thickness – Measurement from the tooth bottom to the backside of the belt. If the belt has ribs on the backside, they are included in the thickness measurement.

Pulley Pitch Diameter – The pulley diameter that coincides with the pitch line of the belt when the belt is engaged with the pulley. The pitch diameter is calculated by multiplying the belt tooth pitch and the number of grooves on the pulley, then dividing the product by π.

Pulley Outside Diameter – Calculated by subtracting two times the P.L.D. from the pulley pitch diameter. This value can be found in the Tooth Configurations chart on page 17.

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FIXED CENTER DRIVES

Center distance is the distance from the center of one pulley to the center of a second pulley (See Fig. 10 on pg. 7). In applications using timing belts, fixed center drives are not recommended. Fixed center implies exact belt tolerances. Although Fenner Precision timing belts are made with precise tolerances, pulley and chassis tolerances associated with the drive must be considered. Fixed center drives do not allow proper belt tensioning and/or belt installation techniques. This can significantly reduce belt performance, shorten belt life, and possibly overload other drive components such as bearings, shafts, and motors.

It is recommended that the drive have one adjustable component so installation is easier and the belt can be tensioned correctly. There are several ways to incorporate an adjustment into a drive system, including adjustable lock-downs or spring-tensioned pulleys/idlers. If your application is currently designed with a fixed center distance, contact a Fenner Precision Applications Engineer to discuss how we can improve the overall performance of your drive.

DRIVE ALIGNMENT

Timing belts are sensitive to misalignment and should not be used where misalignment is inherent in the drive. Any degree of misalignment will result in some reduction in belt life, inconsistent wear, and unequal loading conditions. This effect has the potential to lead to improper belt operation or premature belt failure.

There are two types of drive misalignment: parallel and angular (see Fig. 4 and 5). Parallel misalignment is when the pulley shafts are parallel but the pulleys lie in different planes. Angular misalignment occurs when the pulley shafts are not parallel.

Should some misalignment in the drive occur, it is recommended that the parallelism be within 1/16" per linear foot of center distance and angular tolerance be within 1/4°.

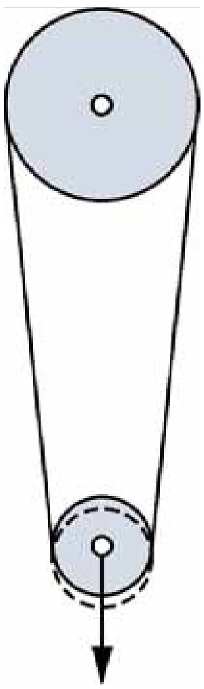

Fig. 3

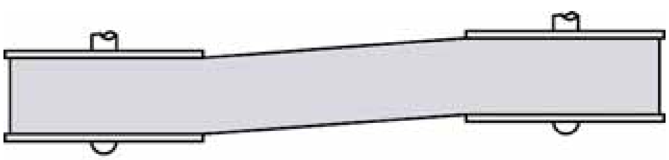

Fig. 4

Fig. 5

IDLERS

Idlers are commonly used to take up belt slack, apply installation tension, or clear obstructions within a system.

In unidirectional drives, idlers should be located on the slack side of the drive (See Fig. 6). Backside (or outside) idlers should be located as close as possible to the driveR pulley in the system. Backside idlers should be flat and flanges are recommended. Diameters of backside idlers should not be smaller than 1.3 times the smallest loaded pulley in the system. Inside idlers should be located as close as possible to the pulley with the most teeth in mesh and should not be smaller in diameter than the smallest loaded pulley in the system. Inside idlers larger than an equivalent 40 groove pulley may be flat.

Spring loaded idlers must be designed to prevent the belt from ratcheting, or “jumping teeth,” under the highest loading conditions of the drive; this includes starting torque or any shock loading which may occur during normal operation.

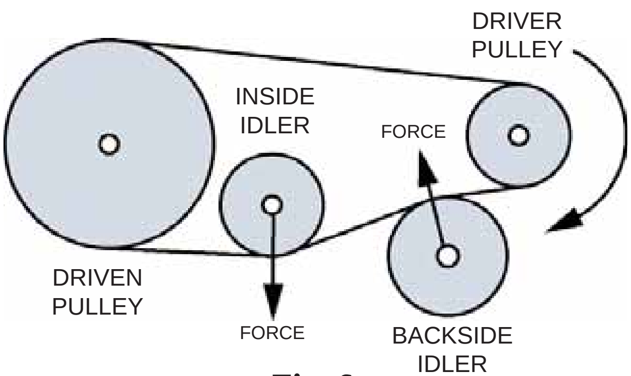

Fig. 6

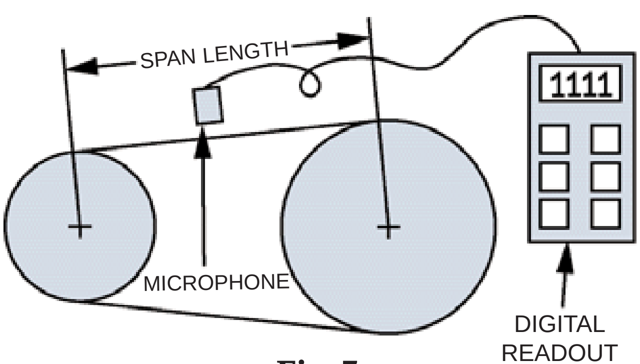

Fig. 7

BELT INSTALLATION AND TENSIONING

When installing a timing belt, be sure that all adjustable components in the system are loose. Do not force the belt over a flange as this will cause internal damage to the belt tensile member, and may result in premature belt failure.

There are several methods used to install a timing belt and adjust its tension. Two of the more common methods, adjustable or spring-loaded idlers and the adjust and lock-down method, are described below.

Adjustable or spring-loaded pulleys/idlers can be used to tension the belt in a drive system. When using adjustable pulleys/idlers, be sure to do a vector analysis of the forces to ensure the proper installed tension in the belt. In a spring loaded system, be sure that the k-value for the spring and spring extension are properly determined during installation. If the belt tension from the applied load is too large, damage to drive components such as the motor, the belt, or bearings may occur. If the belt tension is not sufficient, ratcheting may result.

The adjust and lock-down method applies a force directly to an adjustable input or output shaft of the system (see Figure 3 on page 4). Similar to the spring-loaded pulley/idler method, a vector force analysis is recommended to ensure proper tensioning. Likewise, if the adjustment is made about a pivot point, be sure to calculate the moment developed. The load can be applied to the shaft in a variety of ways. Two commonly used methods are to attach either a static weight or spring scale to the adjustable shaft.

Once the drive has been set, the **sonic tension method** is a common way to determine belt tension (see Fig. 7). This method uses the sound waves generated by “plucking” a single span of the belt. A microphone is held just above the belt in the middle of the plucked span to measure frequency. As installed tension changes, the frequency changes. Through applying known installed loads to the belt, a graph is developed correlating frequency to tension. Once the frequency values are determined, belt tension can be adjusted to the proper value.

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REINFORCEMENT TWIST

The reinforcement in a timing belt typically contains S and Z twisted fibers (see Fig. 8 below)*. The main reason for twisting the reinforcement is to change its physical characteristics. A heavily twisted reinforcement will have improved flexibility, but may exhibit reduced strength. Conversely, a lightly twisted reinforcement will retain most of its strength, but may exhibit poor flexibility.

There are two types of twisted reinforcement constructions that make up a cord: plain and cabled. Plain construction consists of single filaments twisted together. Cabled construction consists of two or more plain constructions twisted together. The amount of twist and the construction of a reinforcement depends on the desired physical characteristics.

Both the S and Z twist are used in a timing belt to aid in tracking. If only one twist is used in a belt, it will track in one direction. Using S and Z twisted reinforcements in a belt stabilizes the tendency to track in one direction. The two twisted reinforcements are placed side-by-side in the belt (See Fig. 9).

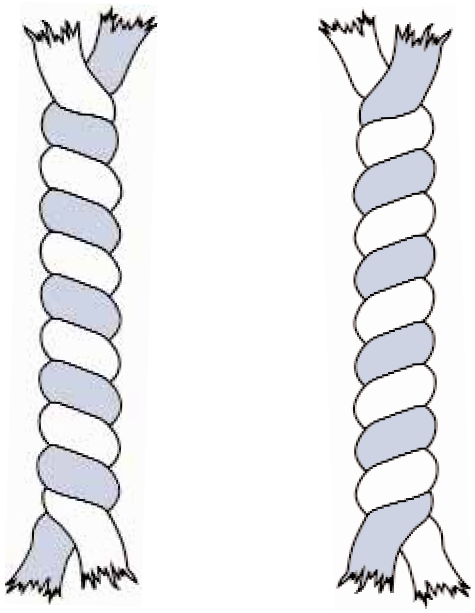


Fig. 8

REINFORCEMENT T.P.I.

Threads per inch (T.P.I.) is the number of twisted cords in a one inch wide belt. Typical Fenner Precision winding pitches are 30 through 72 threads per inch. As cords are wound helically on the mold, filaments can be observed entering and exiting on either side of the belt.

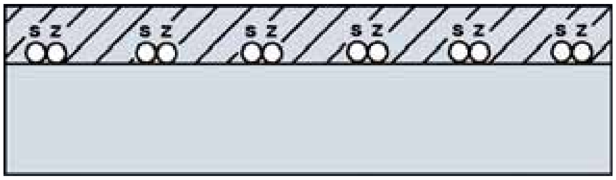
Different winding pitches enable changes in the belt's strength characteristics. A belt with 72 T.P.I. will have a higher break strength than the same belt with 30 T.P.I. containing the same reinforcement type. The reinforcement T.P.I is application dependent and should be discussed with a Fenner Precision Applications Engineer to determine the optimum value for your drive.

PULLEY DESIGN

To optimize belt life, several factors must be considered when designing the pulleys.

- Dimensional accuracy of the profile
- Dimensional accuracy of the outside diameter
- Pulley runout
- Pulley material

Fenner Precision can help with pulley design by supplying drawings of the profiles to match the belts found in this manual. In addition, we can suggest appropriate pulley materials for your application.



Timing Belt Section View

Fig. 9

* Colors are shown for visual clarity only. All twists are done with identical yarns.

CENTER DISTANCE DETERMINATION

Center distance is the distance from the center of one pulley to the center of a second pulley (see Fig. 10 below). The belt is installed in the measuring pulley's grooves and tensioned according to Fenner Precision standards or special design considerations.

The basic formula for two identical pulleys is:

$$CD = [\, P \times (N_B - N_P) / 2 \,] \text{ where:}$$

- CD = center distance
- P = pitch of the belt
- N_B = number of teeth on the belt
- N_P = number of teeth on one measuring pulley

Note: For different sized pulleys, refer to the Center Distance formula on page 9.

The basic formula for Gauge Setting is:

$$GS = CD + D$$

- GS = gauge setting
- CD = center distance
- D = pin diameter

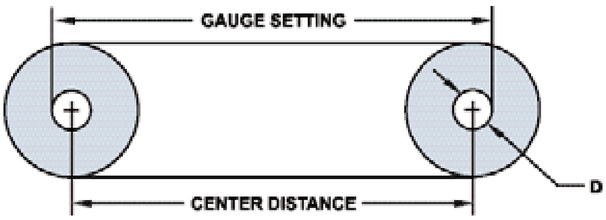


Fig. 10

BELT LENGTH DETERMINATION

1. Install the belt over the measuring pulleys and apply the belt tensioning force smoothly to prevent shock loading.

2. Rotate the pulleys at least two revolutions in order to seat the belt properly into the pulley grooves and divide the tension equally between the two spans of the belt.

3. Read the tolerance from the measuring scale (See Fig. 11). The reading should be added/subtracted to the nominal center distance.

4. Remove the belt immediately after the reading is taken.

5. For timing belts, the pitch length is calculated by adding the pitch circumference of the measuring pulley to twice the measured center distance.

6. For Multi-V belts, the effective length is calculated by adding the effective outside circumference of one of the measuring pulleys to twice the measured center distance between two pulleys.

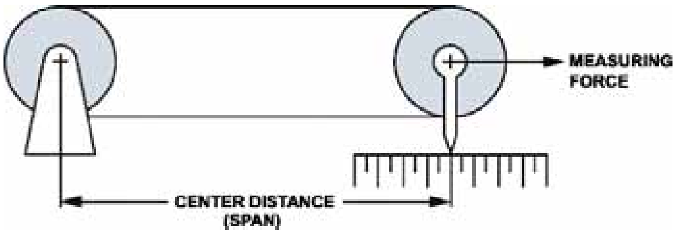


Fig. 11

WIDTH TOLERANCES

RMA standard width tolerance is +0.020"/-0.030" (+0.5mm/-0.8mm)*. For most belts produced by Fenner Precision, the standard tolerance is ±0.015" (0.4mm).

* Rubber Manufacturers Association: Engineering standard ANSI/RMA IP-24-1983

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How To Design a Timing Belt

With step-by-step example on Page 10.

1. Determine the peak torque for your drive. This is usually the motor starting torque, but may also be any unusual momentary or shock loads which may occur during normal operation.

2. Determine the largest pulley diameters that can be utilized, considering the space limitations and drive ratio of your system. This helps to increase the torque capacity of the drive and extends the service life of the belt.

3. Select the belt tooth profile from the quick selection guide on page 16. If the peak drive torque is at the upper limits of torque transmission capability for the selected profile, consider using the next higher torque rated profile. Find the corresponding pitch for the selected profile from the table on page 17. This value will be needed to calculate the number of belt teeth required.

4. Calculate the teeth in mesh (T.I.M.) using the formula table on page 9. Consult the table on page 13 for the teeth in mesh factor. Divide the peak torque (from Step 1) by the T.I.M. factor to determine the design torque. See page 9 for the equation.

IMPORTANT: Check the belt pitch again to make sure this adjustment in torque has not moved your application outside the limits of the desired pitch for the pulleys you chose.

5. Calculate the belt pitch length based on the design center distance of your drive. (Use the equation on page 9).

6. Divide the belt pitch length by the tooth pitch selected and round the result to the nearest whole number. This is the number of teeth on the belt for your application. Adjust the nominal center distance of your drive design to match the belt. (Use the center distance formula on page 9.)

7. Using the formula on page 9, calculate the effective tension (Te) on the drive using the pitch radius and design torque of the smallest loaded pulley in the system.

8. (a) Select the strength factor for your application from the table on page 12. Divide the effective tension from step 7 by the strength factor to determine the required break strength for the belt design. **(b)** Multiply by 2 to represent a double span break. Consult the break strength table on page 13 to determine the required reinforcement type and belt width. The value listed in the table must be greater than the design break strength.

9. Using the torque capacity graphs for the chosen profile (pages 14-15), select a belt width that is capable of handling the design torque with the selected pulley size. **Note:** This belt width may be different from the width selected in step 8. The belt width required for the system will be the wider of the two.

10. Contact Fenner Precision at 800.327.2288 (717.665.2421 outside the US) or visit our website at www.fennerprecision.com to place your order.

Note: Design tools and calculators can be found on our website at www.fennerprecision.com

Engineering Formulas

UNKNOWN	WHERE	FORMULA
Horsepower	hp = horsepower T_d = design torque (oz-in) rpm = motor speed (rev/min)	$hp = \frac{T_d \times rpm}{1.0084 \times 10^6}$
Power	PW = power(kw) hp = horsepower	$PW = 0.7457 \times hp$
Center Distance (using same size pulleys for driveR and driveN)	CD = center distance (in) P = pitch (in) N_B = number of teeth on belt N_P = number of teeth on pulley	$CD = \frac{P \times (N_B - N_P)}{2}$
Center Distance (using unequal size pulleys for driveR and driveN)	CD = center distance (in) PL = belt pitch length (in) D = large pulley pitch dia. (in) d = small pulley pitch dia. (in)	$CD = \frac{b + \sqrt{b^2 - [8 \times (D - d)^2]}}{8}$ $b = (2 \times PL) - [\pi \times (D + d)]$
Belt Pitch Length	PL = belt pitch length (in) CD = center distance (in) D = large pulley pitch dia. (in) d = small pulley pitch dia. (in)	$PL = (2 \times CD) + [1.57 \times (D + d)] + \frac{(D - d)^2}{(4 \times CD)}$
Number of Teeth on Belt	N_B = number of teeth on belt PL = belt pitch length (in) P = tooth pitch (in)	$N_B = \frac{PL}{P}$
Belt Speed	V = belt speed (in/sec) D_r = pitch diameter of driveR pulley rpm = speed of driveR	$V = \frac{D_r \times \pi \times rpm}{60}$
Arc of Contact (smaller pulley)	Ø = arc of contact (°) D = large pulley pitch dia. (in) d = small pulley pitch dia. (in) CD = center distance (in)	$Ø = 180 - \frac{57.3 \times (D - d)}{CD}$
Teeth in Mesh	T.I.M. = teeth in mesh N_d = number of teeth on small pulley CD = center distance (in) D = large pulley pitch dia. (in) d = small pulley pitch dia. (in)	$T.I.M. = \left[0.5 - \left(\frac{D - d}{6 \times CD}\right)\right] \times N_d$
Effective Tension	Te = effective tension (lb) T_d = design torque (oz-in) r = pulley radius (in)	$Te = \frac{T_d}{(16 \times r)}$
Design Torque	T_d = design torque (oz-in) T_{pk} = peak torque (oz-in)	$T_d = \frac{T_{pk}}{T.I.M.\ Factor}$

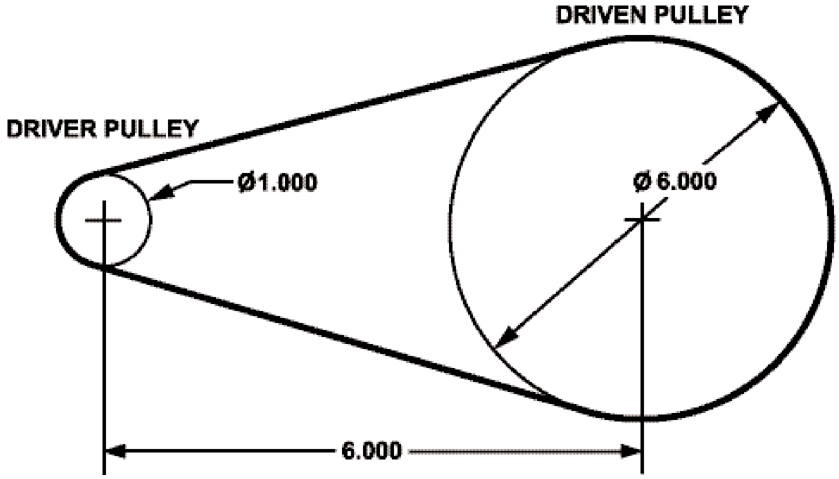
3

3

Example:

Consider the following drive parameters:
75 oz-in peak motor torque (Step 1)
1200 rpm
Requires high accuracy positioning
The driveN pulley and center distance cannot exceed the sizes shown (Step 2)

Fig. 12



(Step 3)
From the *Profile Quick Selection Guide* on page 16, the belt profile selected is FHT-3. This has a corresponding pitch of 3 mm (or 0.1181")

Calculate the closest whole number of pulley grooves for each pulley:
For the driveR pulley:

$$\frac{1 \times \pi}{0.1181} = 26.6$$

Choose a 26 groove driveR pulley because the maximum size of the driveN pulley is limited to 6 inches. The pitch diameter of the drive is then $\frac{26 \times 0.1181}{\pi} = 0.977"$

For the driveN pulley:

26 × 6 = 156 (maintaining a 6:1 drive ratio) yielding a pitch diameter of $\frac{156 \times 0.1181}{\pi} = 5.864"$

(Step 4)
Calculate the teeth in mesh:

$$T.I.M. = \left[0.5 - \frac{(5.864 - 0.977)}{(6 \times 6)}\right] \times 26 = 9.5$$

Since this value is greater than 6, no T.I.M. factor is required.

(Step 5)

Calculate the belt pitch length:

$$P.L. = 2 \times 6 + \left[1.57 \times (5.864 + 0.977)\right] + \frac{(5.864 - 0.977)^2}{(4 \times 6)} \approx 23.735''$$

(Step 6)

Dividing by the pitch of the belt yields 200.978, so a 201 tooth belt should be used that has an actual pitch length of

$$\frac{201 \times 3}{25.4} = 23.740''$$

Recalculate the required center distance using the actual pulley and belt sizes:

$$b = 2 \times 23.740 - [\pi \times (5.864 + 0.977)] = 25.988$$

$$CD = \frac{25.988 + \sqrt{25.988^2 - [8 \times (5.864 - 0.977)^2]}}{8} = 5.999''$$

(Step 7)

Calculate the effective tension (Te):

$$Te = \frac{75}{16\left(\frac{0.977}{2}\right)} = 9.6 \text{ lbs.}$$

(Step 8)

Applying the strength factor to determine the required break strength (a). Then multiply by two for a Double Span Break (b):

(a) $\frac{9.6}{0.1} = 96$ lbs. (b) $96 \times 2 = 192$ lbs.

From the break strength tables on page 13, a width of 6 mm is needed using FR-23 fiberglass at 60 T.P.I.

(Step 9)

From the torque capacity graphs, a 5 mm wide belt is required to handle the torque requirement. Compare this value with the width calculated in Step 8. The larger value will be the width required for the application. In this example it is 6mm.

(Step 10)

Contact Fenner Precision with the following information:

201T FHT-3, FR-23 Fiberglass reinforcement at 60 T.P.I., 6mm wide

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TORQUE CONVERSION TABLE

A \ B	dyne-cm	gm-cm	oz-in	Kg-cm	lb-in	N-cm	lb-ft	Kg-m
dyne-cm	1	1.019×10^{-3}	1.416×10^{-5}	1.0197×10^{-6}	8.850×10^{-7}	10^{-5}	7.375×10^{-8}	1.019×10^{-8}
gm-cm	980.665	1	1.388×10^{-2}	10^{-3}	8.679×10^{-4}	9.806×10^{-3}	7.233×10^{-5}	10^{-5}
oz-in	7.061×10^{4}	72.007	1	7.200×10^{-2}	6.25×10^{-2}	.7061	5.208×10^{-3}	7.200×10^{-4}
Kg-cm	9.806×10^{5}	1000	13.877	1	.8679	9.806	7.233×10^{-2}	10^{-2}
lb-in	1.129×10^{6}	1.152×10^{3}	16	1.152	1	11.2	8.333×10^{-2}	1.152×10^{-2}
N-cm	10^{5}	101.97	1.416	.102	8.85×10^{-2}	1	7.37×10^{-3}	1.01×10^{-3}
lb-ft	1.335×10^{7}	1.382×10^{4}	192	13.825	12	135.5	1	.138
Kg-m	9.806×10^{7}	10^{5}	1.388×10^{3}	100	86.796	980.6	7.233	1

* To convert from A to B, multiply by entry in table.

STRENGTH FACTOR

Drive Description	Examples	Strength Factor
Critical Positioning Tolerance and Accuracy	Pen Plotter Printers Pick and Place Robots	**0.02**
High Positioning Tolerance and Accuracy	Medical Equipment Paper Handling Security Cameras	**0.10**
Low Positioning Tolerance and Accuracy	Home Appliances Currency Equipment Light Load Unidirectional Drives	**0.20**

PROFILE SPECIFICATIONS

	Min. Pulley/Idler Dia.*	**# Grooves on Pulley**	**Min. Installed Tension Per Inch of Width****		
Urethane \ Reinforcement	**FR-2, FR-17, and FR-23**		**FR-2 Kevlar**	**FR-17 Kevlar**	**FR-23 Glass**
FHT-1	0.291(7.4)	24	18(32)	24(42)	18(32)
FHT-2	0.331(8.4)	14	18(32)	24(42)	18(32)
FHT-3	0.496(12.6)	14	18(32)	24(42)	18(32)
MXL40	0.286(7.3)	12	18(32)	24(42)	18(32)
MXL60	0.286(7.3)	12	18(32)	24(42)	18(32)

* All units are [in(mm)]

** All units are [lb/in(N/cm)]

Design Torque Calculation:

$$T_d = \frac{T_{pk}}{T.I.M.\ Factor}$$

where: T_d = design torque
T_{pk} = peak torque

TEETH IN MESH FACTOR	
Teeth in Mesh on Driver	T.I.M. Factor
6 or more	1.0
5	0.8
4	0.6
3	0.4
2	0.2

BREAK STRENGTH*

Width		FR-2 Kevlar		FR-17 Kevlar		FR-23 Glass	
		60 TPI**	72 TPI	40 TPI	50 TPI***	50 TPI	60 TPI**
Inch	mm	Lbf.(N)	Lbf.(N)	Lbf.(N)	Lbf.(N)	Lbf.(N)	Lbf.(N)
0.079	2.0	135(595)	165(735)	130(575)	165(730)	60(265)	75(330)
0.094	2.4	165(730)	200(890)	155(690)	195(860)	75(335)	85(375)
0.102	2.6	180(795)	215(955)	170(755)	210(930)	80(355)	95(420)
0.118	3.0	205(905)	250(1110)	195(865)	245(1085)	90(400)	110(485)
0.125	3.2	220(975)	265(1180)	210(935)	260(1150)	95(420)	120(530)
0.157	4.0	275(1220)	335(1490)	265(1180)	330(1465)	125(555)	150(660)
0.189	4.8	335(1485)	400(1780)	315(1400)	395(1750)	150(665)	180(795)
0.197	5.0	350(1550)	420(1870)	330(1465)	415(1840)	155(690)	190(840)
0.236	6.0	420(1865)	500(2225)	395(1755)	495(2195)	190(845)	225(995)
0.250	6.4	445(1975)	535(2380)	420(1865)	525(2330)	200(890)	240(1065)
0.276	7.0	490(2175)	590(2625)	465(2065)	580(2575)	220(980)	265(1175)
0.315	8.0	560(2485)	675(3005)	530(2355)	665(2955)	255(1135)	305(1350)
0.354	9.0	630(2795)	755(3360)	595(2645)	745(3310)	285(1265)	345(1530)
0.375	9.5	670(2975)	800(3560)	635(2825)	790(3510)	300(1335)	365(1620)
0.394	10.0	700(3110)	845(3760)	665(2955)	830(3685)	315(1400)	380(1685)
0.472	12.0	840(3730)	1010(4495)	800(3555)	995(4420)	380(1690)	460(2040)
0.500	12.7	890(3955)	1070(4760)	845(3760)	1055(4690)	405(1800)	485(2150)

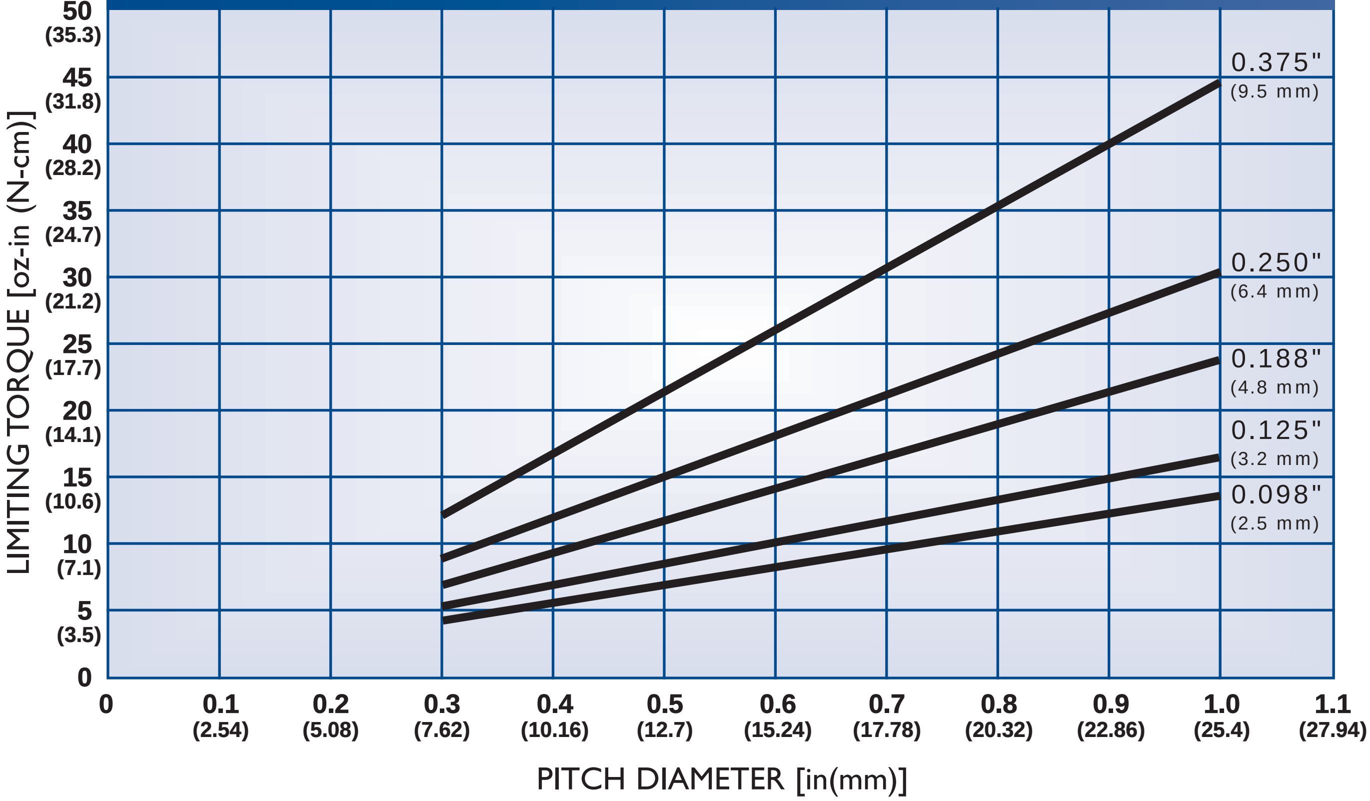
* All breaks are a Double Span Break. All break strengths measured using a universal Tensile/Compression Test Machine. Different TPIs are listed for comparison

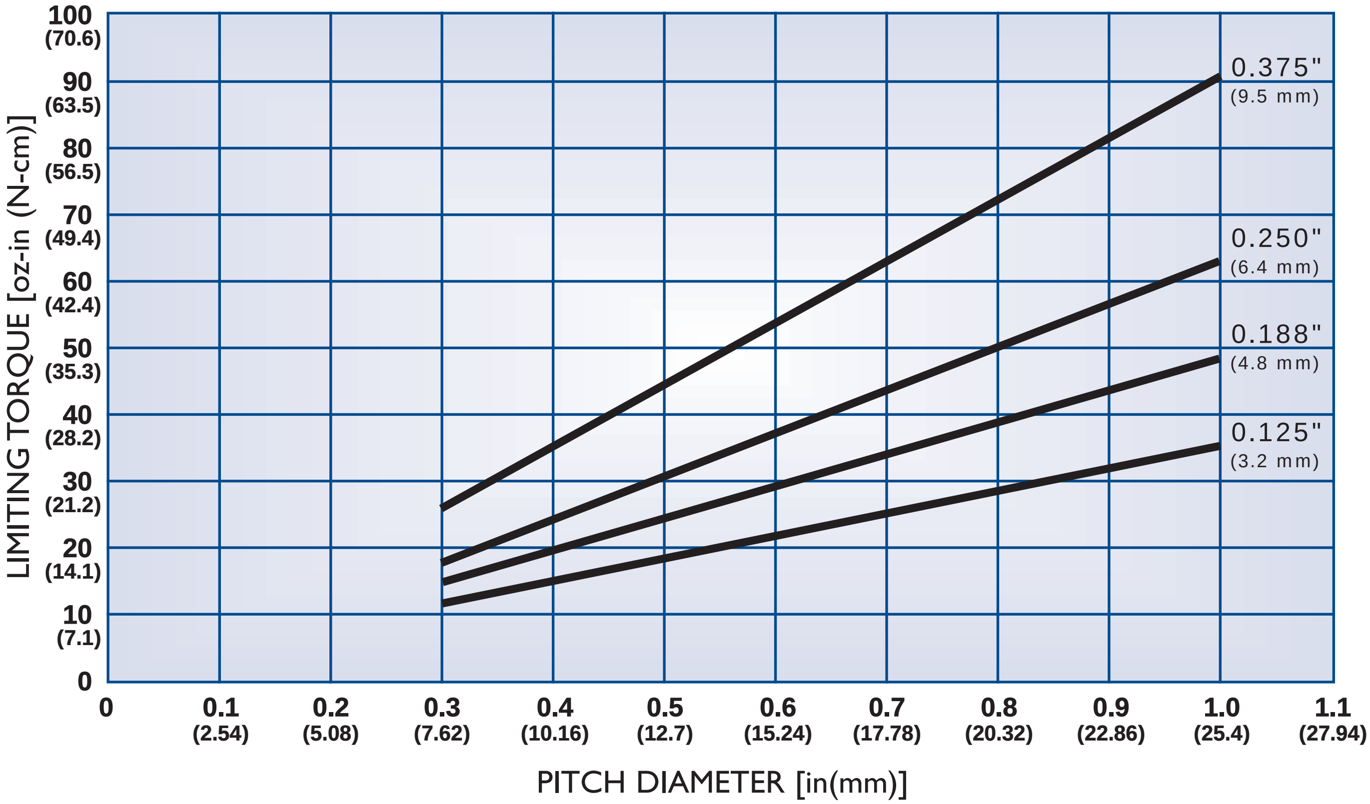
** 60 T.P.I. is standard for FR-2 and FR-23 reinforced standard stock size belts

*** 50 T.P.I. is standard for FR-17 reinforced standard stock size belts

Profile Characteristics

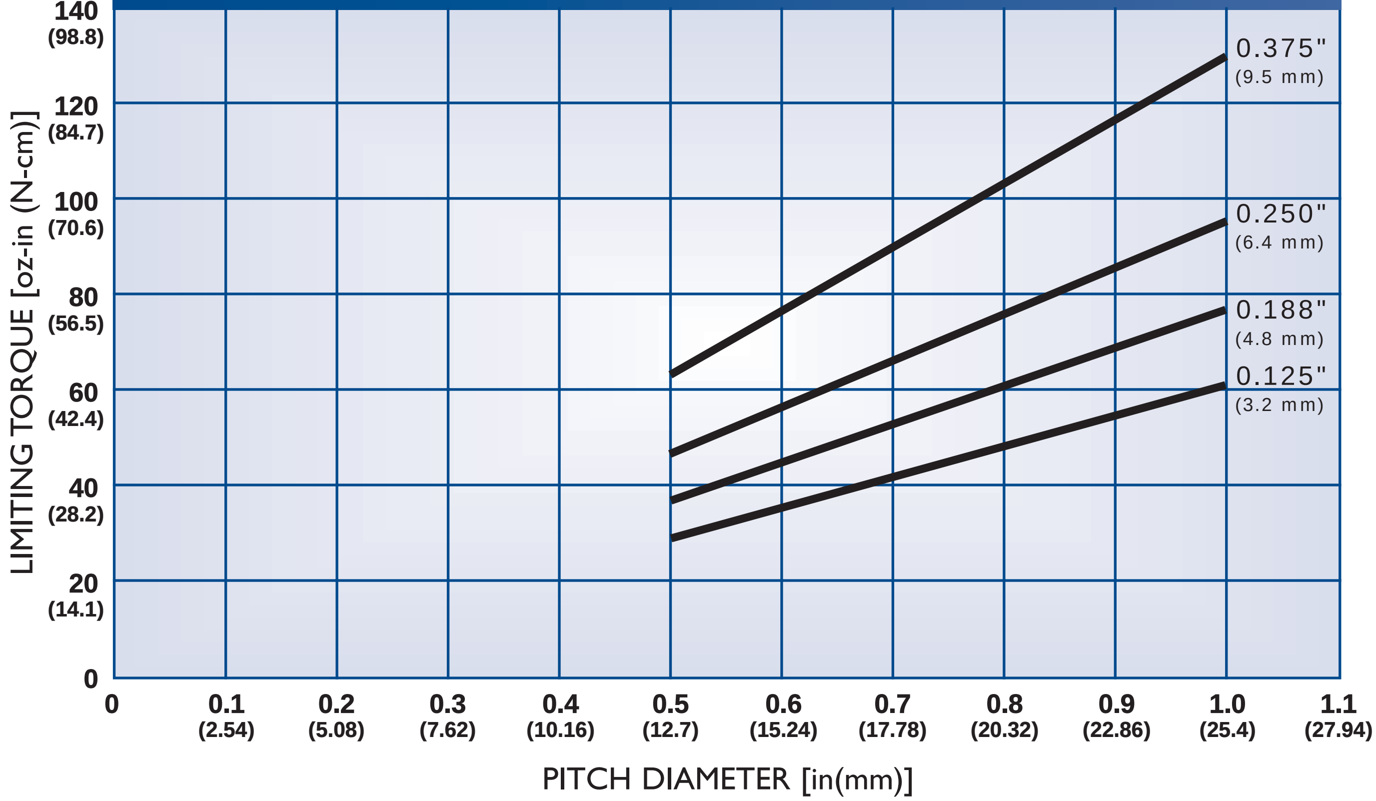
FHT-1 TORQUE CAPACITY at various widths containing FR-17 Kevlar @ 50 T.P.I.

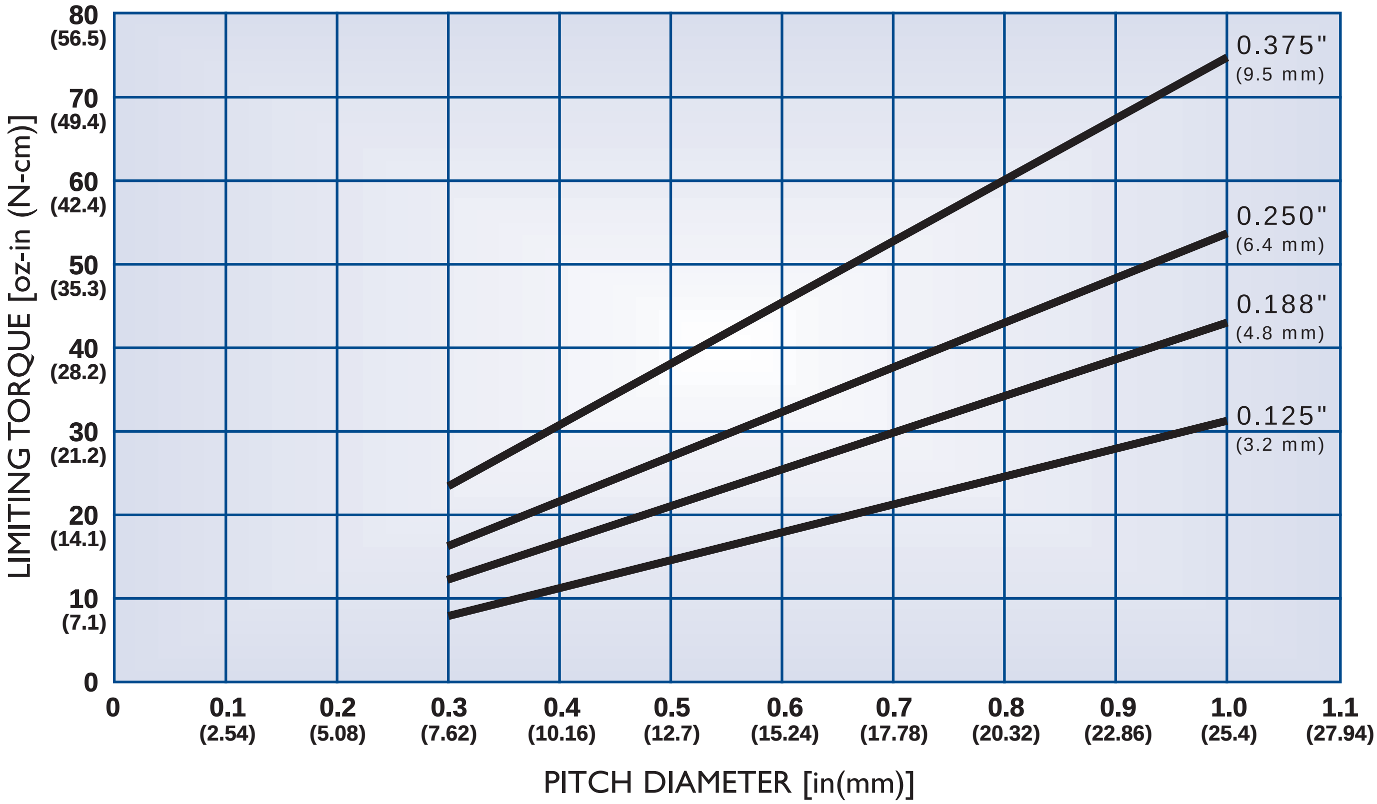




Note: The torque values for widths within +/- 0.020" or 0.5mm of an existing curve (line) are approximately equal to the curve (line) provided.

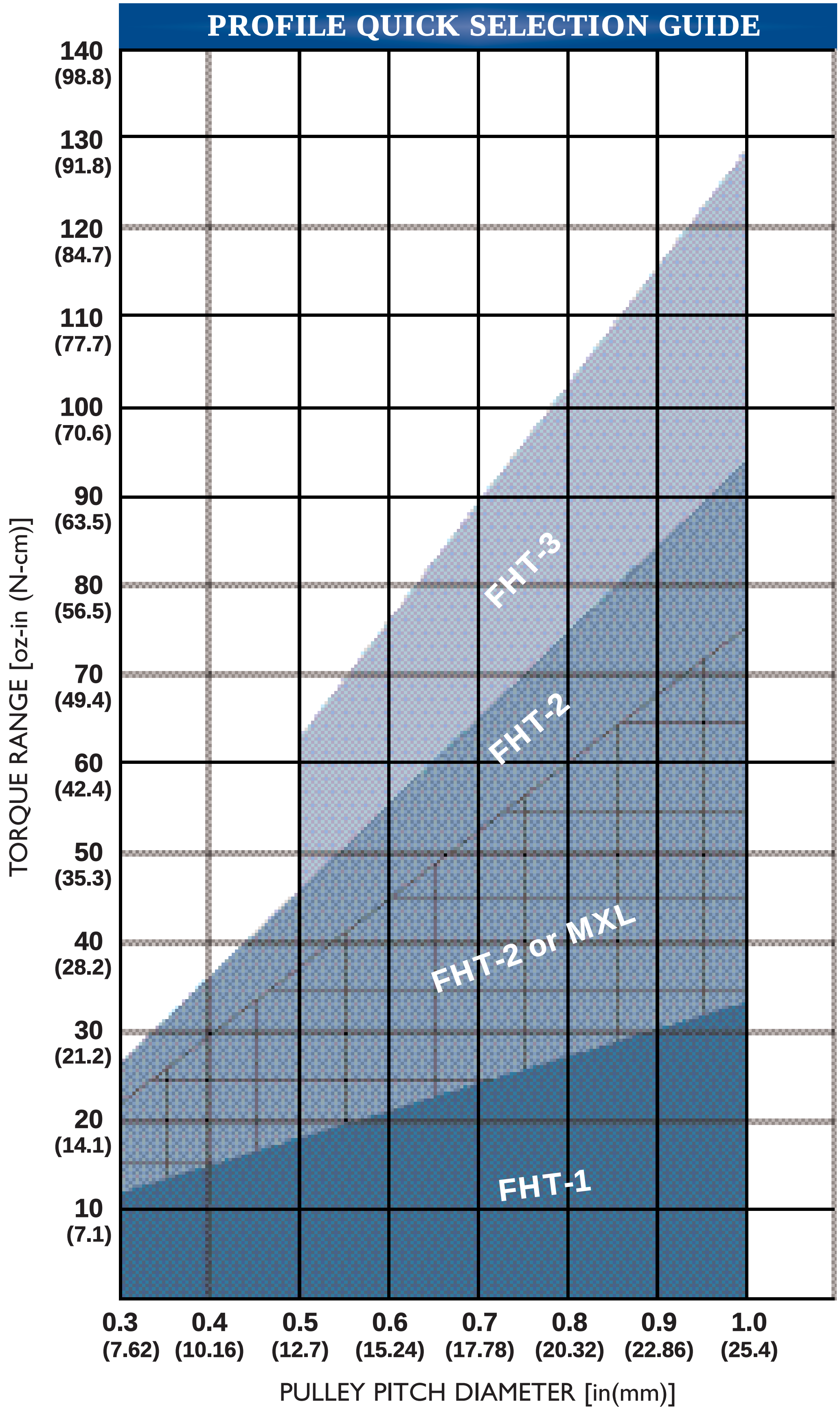
FHT-3 TORQUE CAPACITY at various widths containing FR-17 Kevlar @ 50 T.P.I.





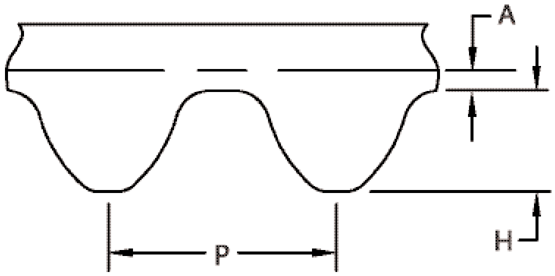
Note: The torque values for widths within +/- 0.020" or 0.5mm of an existing curve (line) are approximately equal to the curve (line) provided.

Profile Characteristics



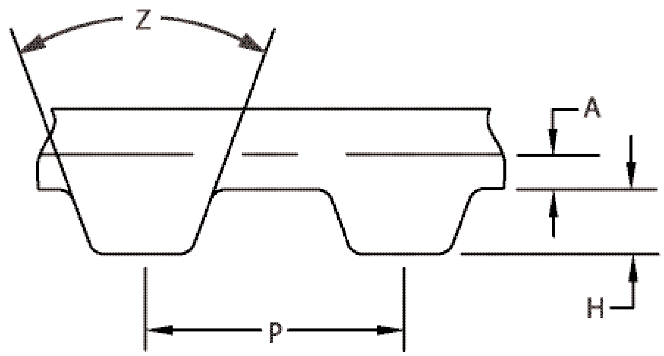
Note: Torques based on 1/4"(6.4 mm) wide belt at recommended installed tension. For Other torques or more detailed information, consult a Fenner Precision Applications Engineer.

Profile Basics



STYLE A: Curvilinear Profile

Fig. 13



STYLE B: Trapezoidal Profile

Fig. 14

STANDARD TOOTH DIMENSIONS [in(mm)]					
	Style	P	H	2A	Z
FHT-1	A	0.0393 (1.000)	0.015 (0.38)	0.010 (0.25)	na
FHT-2	A	0.0787 (2.000)	0.030 (0.76)	0.020 (0.51)	na
FHT-3	A	0.1181 (3.000)	0.045 (1.14)	0.030 (0.76)	na
MXL40	B	0.0800 (2.032)	0.020 (0.51)	0.020 (0.51)	40°
MXL60	B	0.0800 (2.032)	0.018 (0.46)	0.020 (0.51)	60°
XL	B	0.2000 (5.080)	0.050 (1.30)	0.020 (0.51)	50°

Cord Support Styles

HALF-ROUND CORD SUPPORT

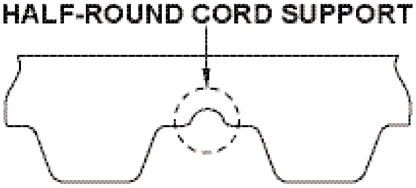


Fig. 15

ROOFTOP CORD SUPPORT

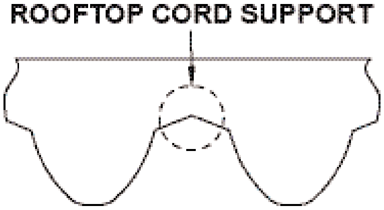


Fig. 16

NO CORD SUPPORT

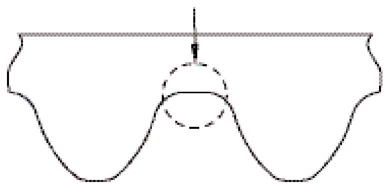


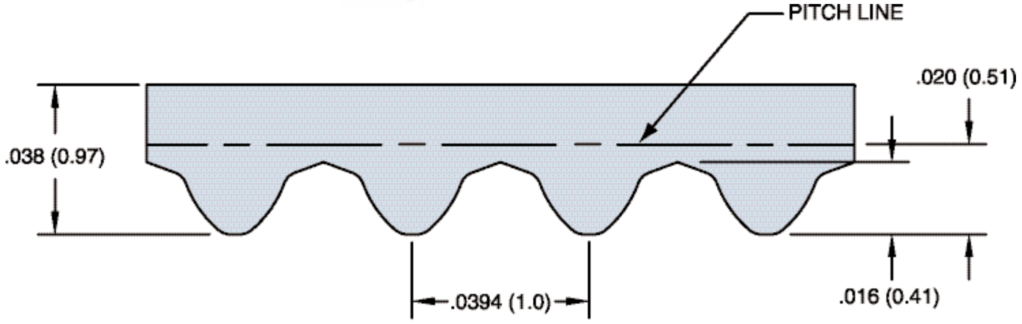
Fig. 17

Curvilinear Profiles

Curvilinear profiles offer improved noise reduction and positioning accuracy for low-torque drives.
Note: All units are [in.(mm)]

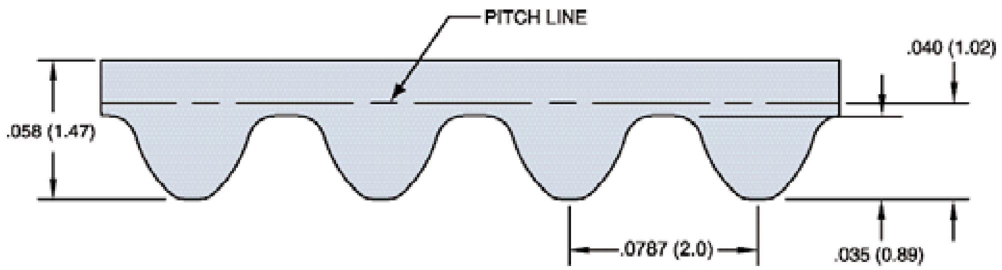
FHT-1 Profile

Fig. 18



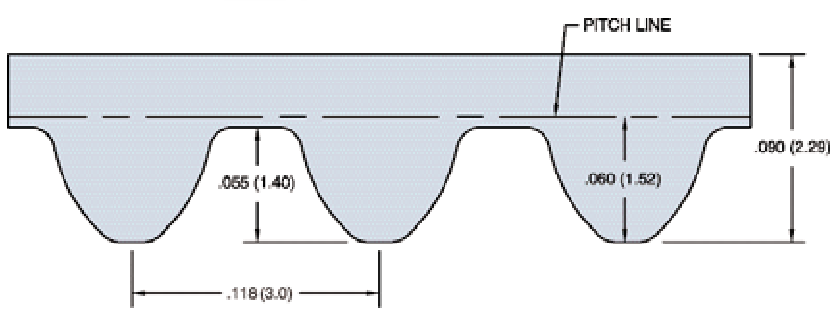
FHT-2 Profile

Fig. 19



FHT-3 Profile

Fig. 20



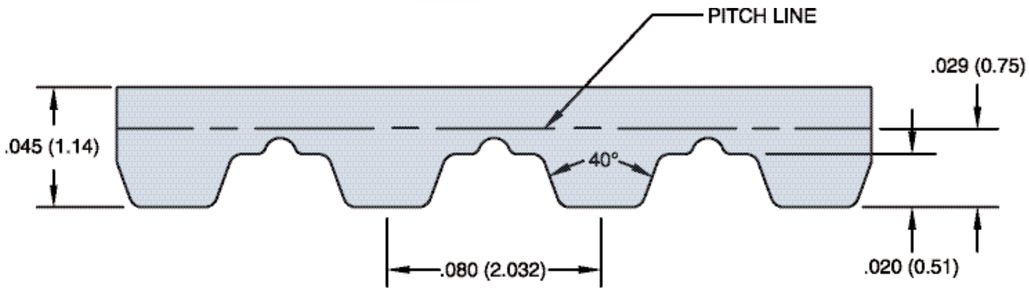
Note: Fenner Precision also offers the FHT-2.032 profile having the same tooth pitch as the common MXL profile.

Trapezoidal Profiles

Trapezoidal profiles are available for designs based on industry standards.
Note: All units are [in.(mm)]

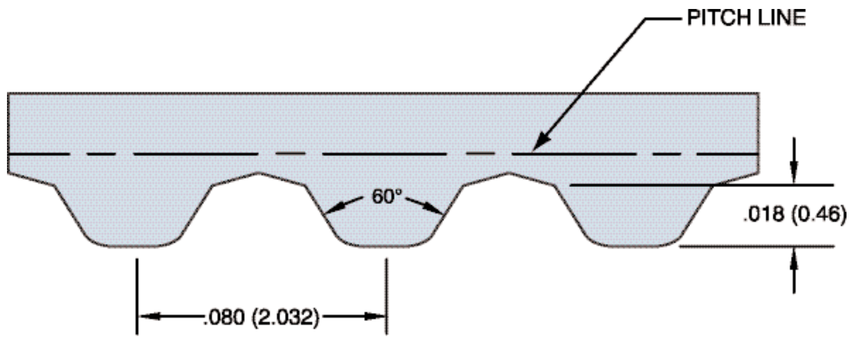
MXL 40 Profile

Fig. 21



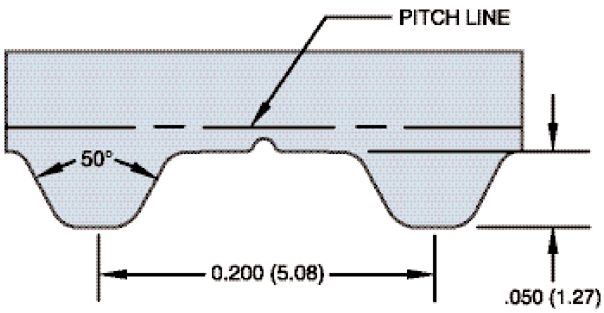
MXL 60 Profile

Fig. 22



XL Profile

Fig. 23



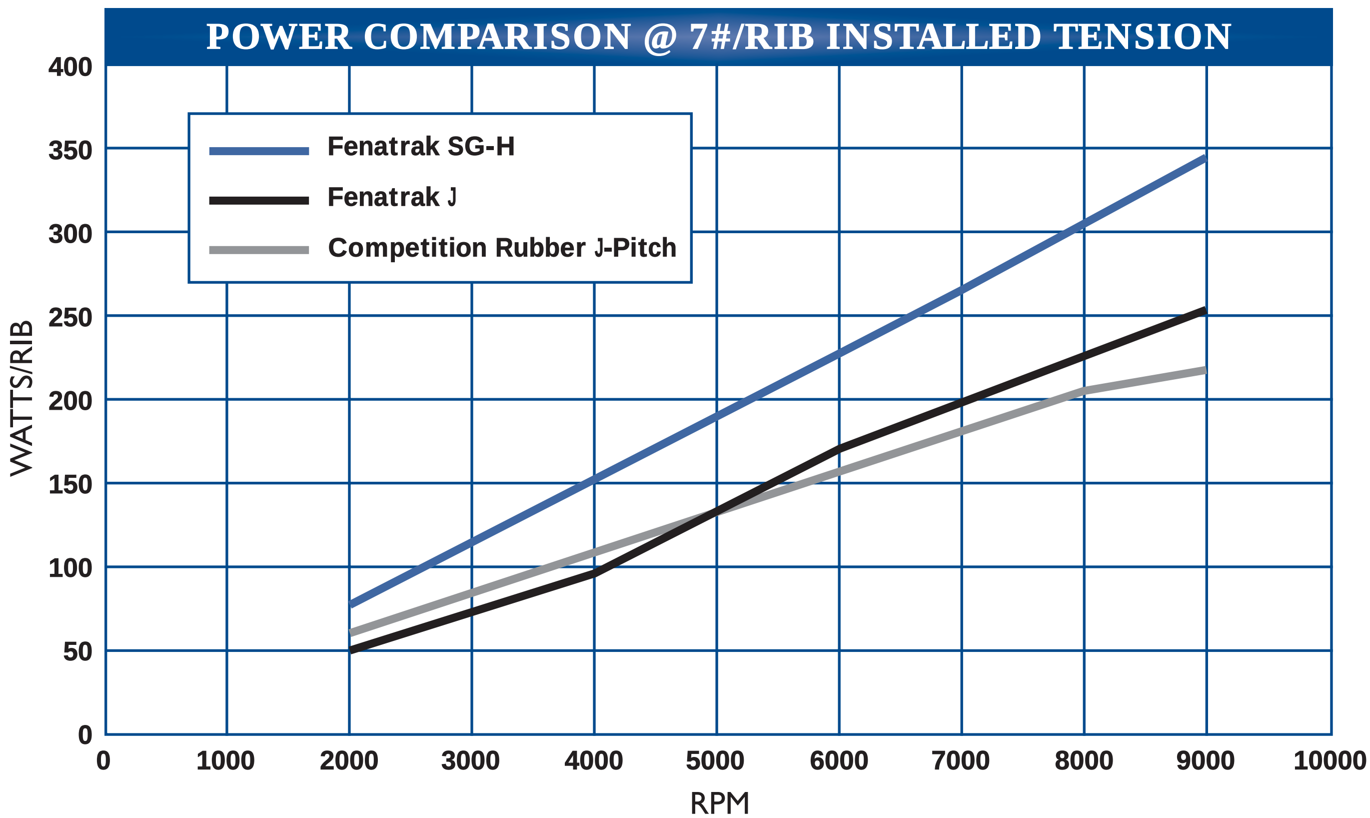
4

Fenatrak® Multi-V Profiles

Fenatrak® multi-V belts are ideally suited for non-synchronous drives that may experience high-speeds, high-torque, severe shock-loading, and/or stalling conditions*. In addition to [P]H and [P]J profiles, Fenner Precision offers a "Super Grip" (SG™) line of H and J type multi-V belts designed to meet or exceed conventional RMA power transmission standards. The SG profiles exhibit better gripping properties by utilizing the unique characteristics of urethanes.

Multi-V belts are designed to transfer power from the driveR pulley to the belt by the frictional forces between the contact surfaces. One design advantage of a multi-V belt is that it will slip in a stall condition. Other advantages of using Fenatrak multi-V belts include quiet drive operation, reduced vibration due to the longitudinal rib profile, good resistance to chemicals, and application specific COF values. Contact a Fenner Precision Applications Engineer for inquiries regarding special profiles and features.

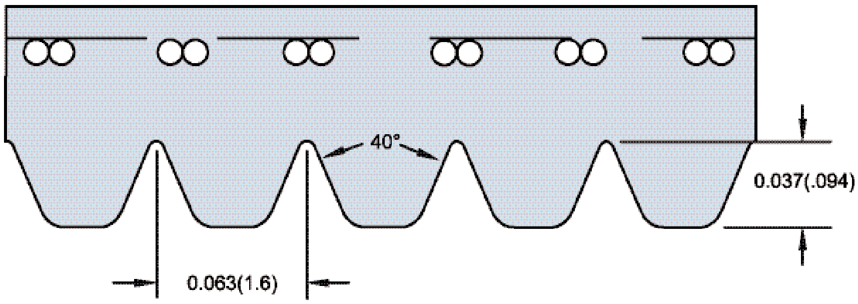
Shown on page 21 are three available Fenatrak multi-V belt profiles: H, SG-H, and J. Fenatrak belts are made with a variety of reinforcements; standard reinforcements are found in section Five (5) of this manual. The power carrying potential for a multi-V belt is dependant on selecting the correct profile, belt width (number of ribs), and the correct belt tension. Please contact Fenner Precision for assistance choosing the correct profile, width, and tension for your Fenatrak multi-V belt drive application.



* Multi-V belts are not designed to replace clutches in your drive system.

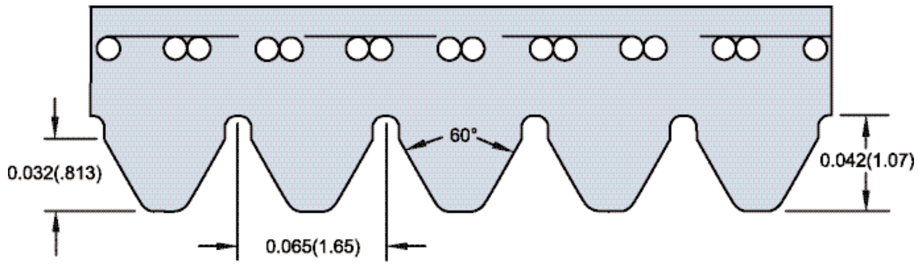
Fenatrak® H Profile

Fig. 24



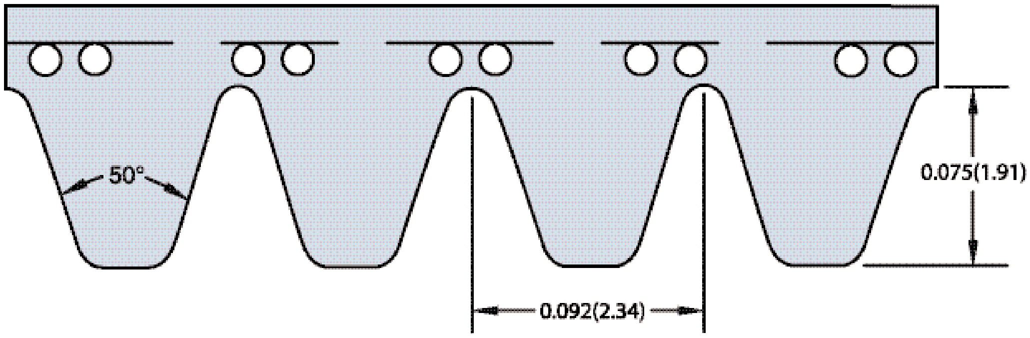
Fenatrak SG®-H Profile

Fig. 25



Fenatrak J Profile

Fig. 26



Note: These are section views. All units are [in.(mm)]

Reinforcement Characteristics

The majority of Fenner Precision applications use either Kevlar®, polyester, or fiberglass.

REINFORCEMENT	TYPE	FLEXIBILITY	STRENGTH	POSITIONING ACCURACY	HEAT STABILITY	MOISTURE STABILITY
FR-2	Kevlar	G	VG	E	VG	VG
FR-17	Kevlar	VG	VG	VG	VG	VG
FR-23	Glass	VG	G	E	E	E

G = Good VG = Very Good E = Excellent

Flexibility – Based on reduction in original break strength after one million flexes around 0.153" (3.9 mm)radius.

Strength – Based on the belt's failure point using universal Tensile/Compression Tester.

Positioning Accuracy – Based on repeatable indexing over 1000 hours running at 1750 rpm.

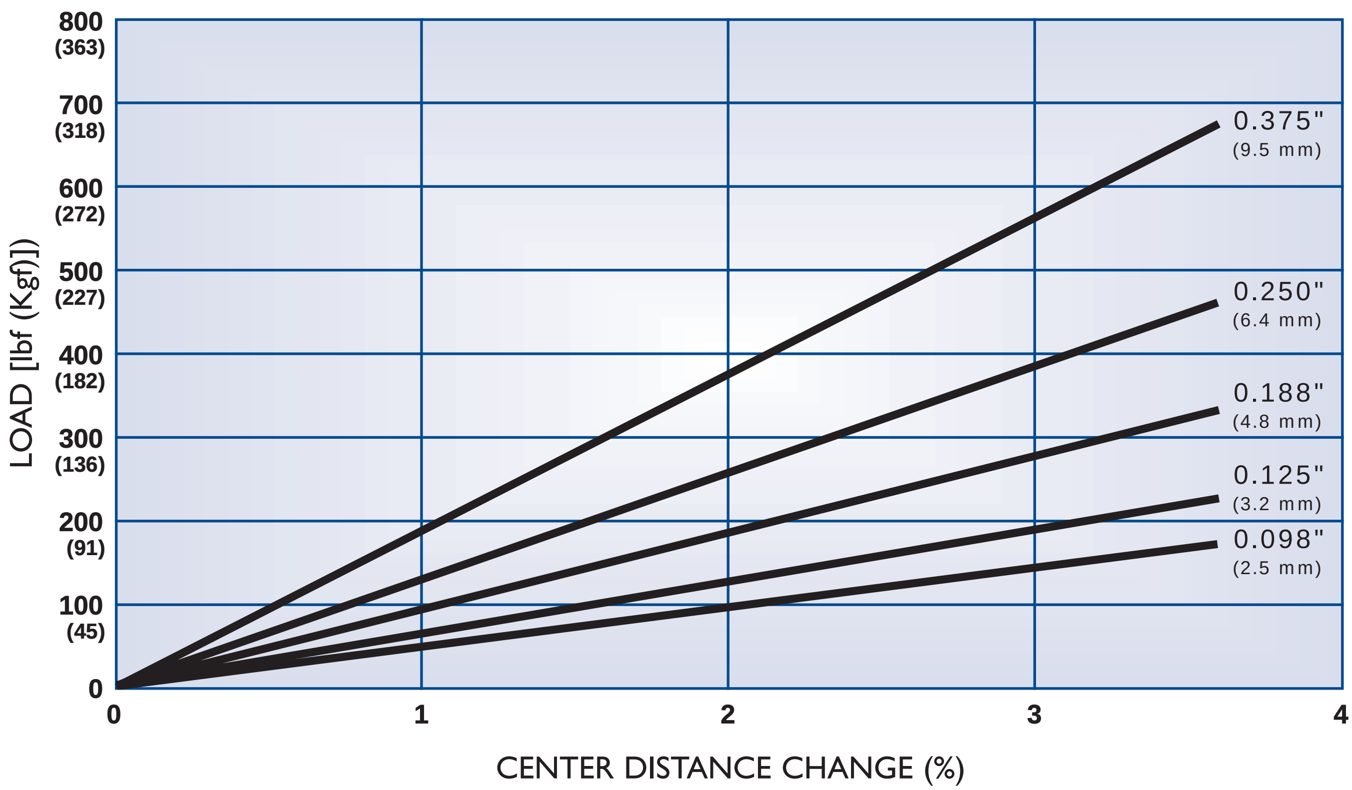
Heat Stability – Based on reduction in strength when exposed to 200°F (93°C) for 24 hours.

Moisture Stability – Based on change in original length of samples soaked in water at 70°F (21°C) for 24 hours.

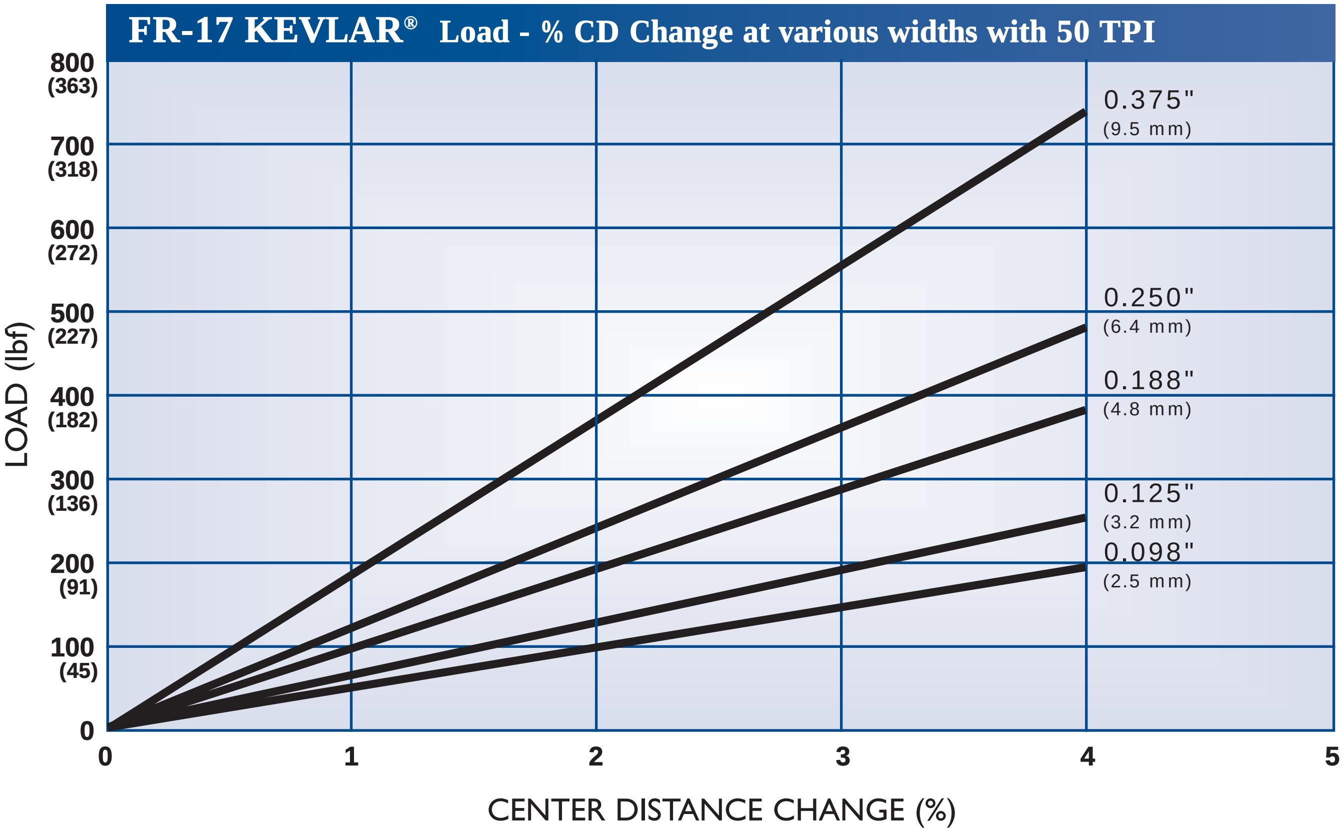
Characteristics based on Fenner Precision standard T.P.I for the particular reinforcement.

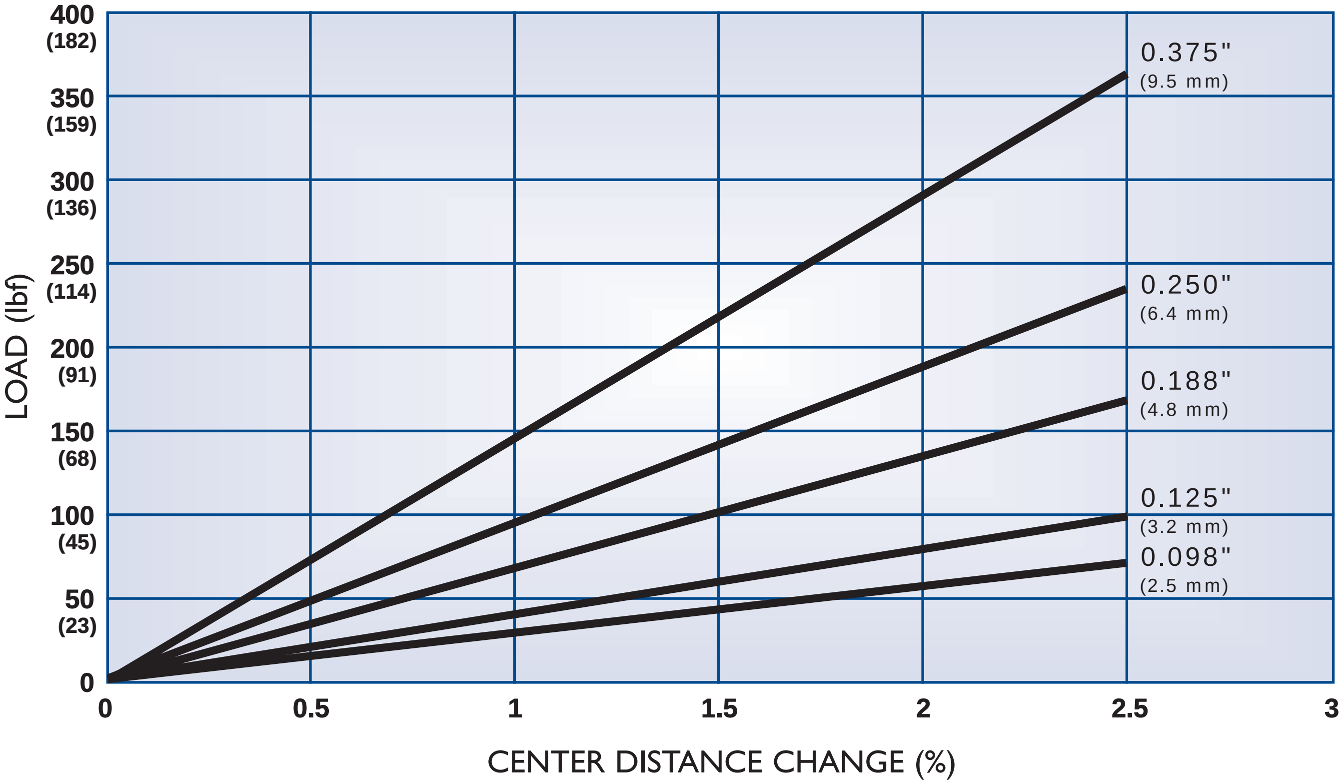
Note: Crimping a fiberglass belt will cause premature failure.

5



Note: The torque values for widths within +/- 0.020" or 0.5mm of an existing curve (line) are approximately equal to the curve (line) provided.





Note: The torque values for widths within +/- 0.020" or 0.5mm of an existing curve (line) are approximately equal to the curve (line) provided.

ADVANTAGES OF THERMOSET POLYURETHANES

- Unaffected by oil, water, ozone, and most chemicals
- Accurate molding tolerances
- High resistance to abrasion
- Homogeneous construction eliminates delamination
- Long shelf life
- Integrally molded backside features
- Highly detailed profiles and features

Selection guide of elastomers for use in a wide range of environmental and mechanical conditions.

CAPABILITIES

Resilient	Resilient	Resilient	Resilient	Resilient
Elastic Memory	Elastic Memory	Elastic Memory	Elastic Memory	Elastic Memory
	Oil & Grease Resistant	Oil & Grease Resistant	Oil & Grease Resistant	Oil & Grease Resistant
		Weather, Ozone, Age Resistant	Weather, Ozone, Age Resistant	Weather, Ozone, Age Resistant
			Abrasion Resistant	Abrasion Resistant
				High Load Bearing Capacity

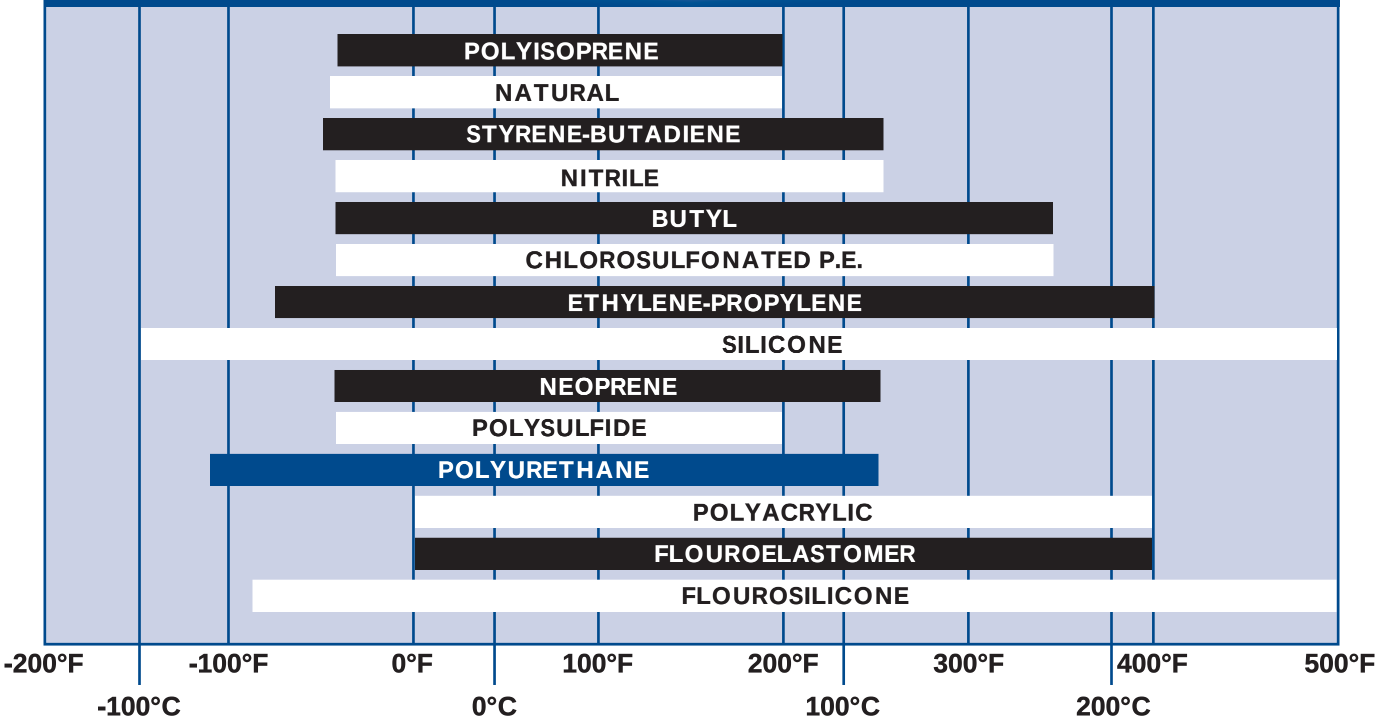
QUALIFYING ELASTOMERS

Polyurethane Nitrile Styrene-Butadiene Chlorosulfonated P.E. Ethylene Propylene Silicone Flourosilicone Flouroelastomer Polyacrylic Neoprene Butyl Polysulfide Polyisoprene	Polyurethane Chlorosulfonated P.E. Flourosilicone Flouroelastomer Polyacrylic Neoprene Polysulfide Polyisoprene	Polyurethane Chlorosulfonated P.E. Flourosilicone Flouroelastomer Polyacrylic Neoprene Polysulfide	Polyurethane	Polyurethane

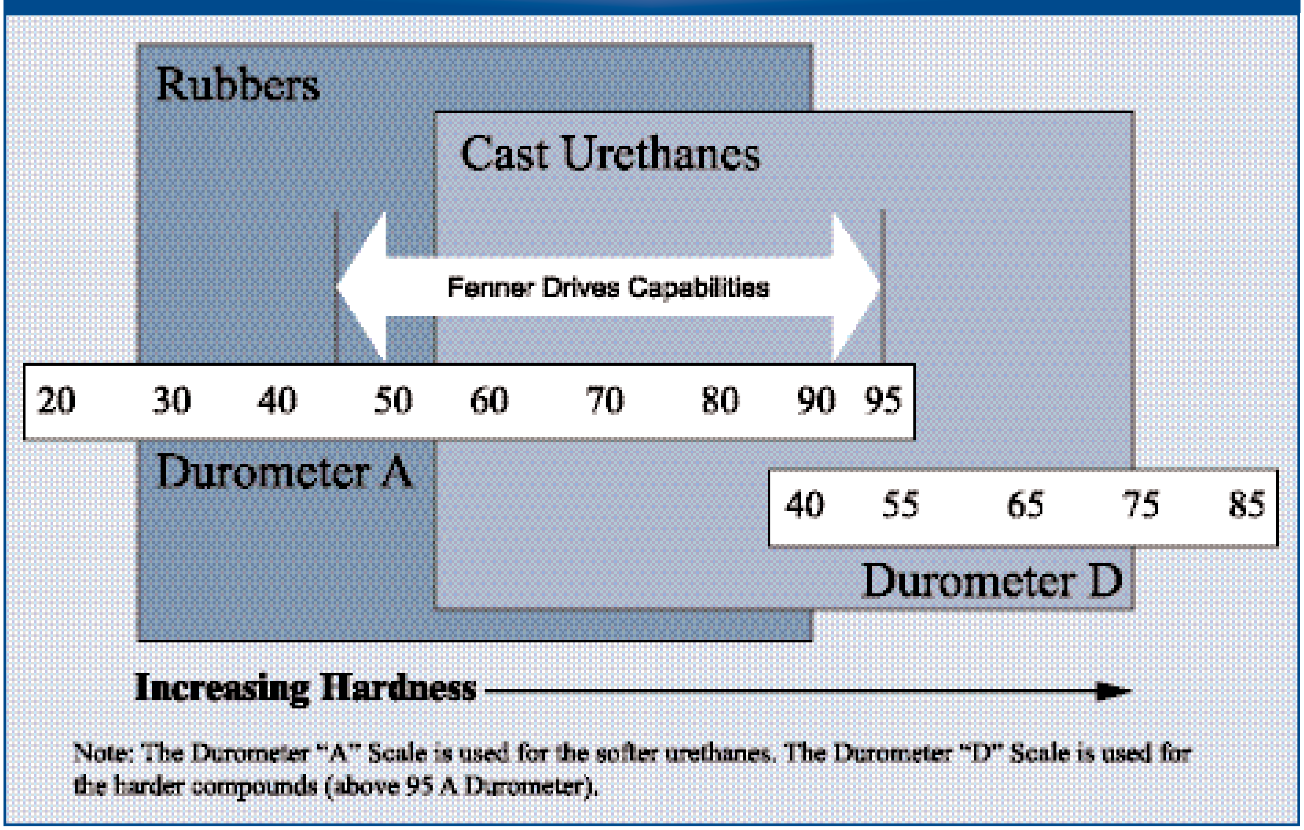
Urethane Characteristics

Note: Fenner Drives standard urethane material has a recommended operating or storage temperature range of -40°C through +80°C (± 5°C).

USEFUL TEMPERATURE RANGE* OF COMMERCIAL ELASTOMERS



HARDNESS SCALE



* Useful temperature ranges for belting applications will vary. Please contact Fenner Precision with your application requirements.

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Urethane Characteristics

STANDARD URETHANES

Urethane	Durometer** (±5)	Tensile Strength	Ultimate Elongation	Bashore Resilience	Taber Abrasion	Static COF	Static COF	Standard Color***
	(Shore A)	$[lb/in^2\ (N/cm^2)]$	(%)	(%)	(mg lost / 1000 cycles)	(20# Paper)	(Mild Steel)	
TG-01*	80	4072.5(2806.0)	510%	56%	39.9	0.55	0.62	Black
TG-02	80	4072.5(2806.0)	510%	56%	39.9	0.55	0.62	Grey
TG-03	75	3275.1(2256.5)	545%	58%	49.6	0.59	0.58	Black
TG-13	90	3894.8(2683.5)	490%	46%	47.0	0.64	0.65	Black
TG-14	90	3894.8(2683.5)	490%	46%	47.0	0.64	0.65	Grey
TG-27	80	4025.1(2773.3)	545%	51%	48.9	0.51	0.55	Black
TG-28	80	4025.1(2773.3)	545%	51%	48.9	0.51	0.55	Grey
TG-35	85	2160.0(1488.2)	360%	53%	51.0	0.92	0.31	Green

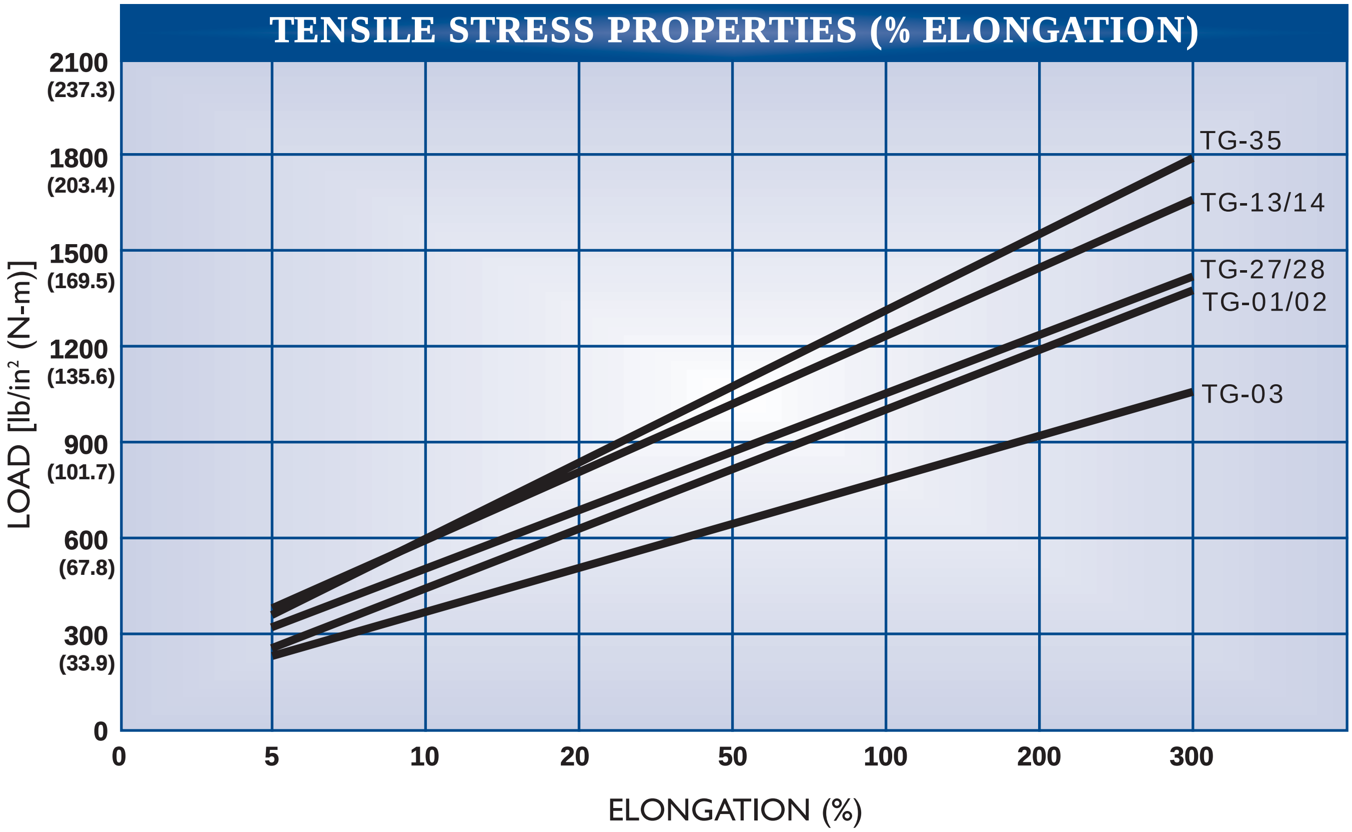
* TG-01 urethane is used for all standard stock size belts.
** Special durometers are available down to 45 Shore A. Consult Fenner Precision for your unique application.
*** Custom colors also available with minimum order.

ELASTOMER COMPARISON DATA

Urethane	Shore A Durometer	Tensile Strength	Modulus	Tear Resistance	Rebound	Tensile Set	Wear Resistance	Static COF Against Paper
TG-01	80	✪✪✪	✪✪	✪✪✪	✪✪✪	✪✪	✪✪✪	✪✪
TG-03	75	✪✪✪	✪✪	✪✪✪	✪✪✪	✪✪	✪✪✪	✪✪✪
TG-13	83	✪✪✪✪	✪✪✪	✪✪✪✪	✪✪	✪✪	✪✪✪	✪
TG-36	85	✪✪✪½	✪✪✪	✪✪✪	✪✪	✪✪✪	✪✪✪	✪✪
50E	52	✪✪	✪	✪	✪✪✪	✪✪	✪✪✪	✪✪✪✪
60E	62	✪	✪	✪	✪✪✪✪	✪	✪✪	✪✪✪
70E	72	✪✪	✪✪	✪✪	✪✪✪	✪	✪✪✪✪	✪✪✪
80E	77	✪✪	✪✪	✪✪	✪✪✪	✪✪	✪✪✪	✪✪✪
85E	82	✪✪	✪✪	✪✪	✪✪✪	✪	✪✪✪	✪✪✪
95P	91	✪✪✪	✪✪✪✪	✪✪✪✪	✪✪	✪✪✪	✪✪✪	✪✪
	Competitive Belting Materials							
Neoprene	73	✪✪	✪	✪✪	✪	✪✪✪✪	✪	✪✪✪
EPDM	68	✪✪✪	✪	✪	✪	✪✪✪✪	✪	✪✪✪✪

KEY		
	✪✪✪✪	Highest
	✪✪✪	↓↓
	✪✪	↓
	✪	Lowest

Urethane Tensile Stress Properties



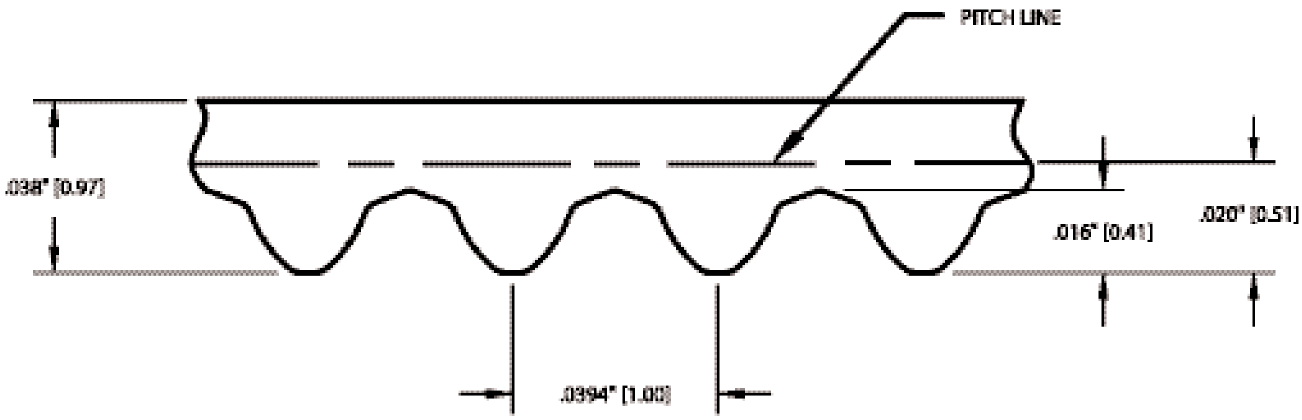
TENSILE STRESS PROPERTIES* (% ELONGATION)

Urethane \ Elongation	5%	10%	20%	50%	100%	200%	300%
TG-01	285(195)	385(265)	500(345)	695(480)	870(600)	1085(750)	1375(945)
TG-02	285(195)	385(265)	500(345)	695(480)	870(600)	1085(750)	1375(945)
TG-03	230(160)	305(210)	395(270)	560(385)	710(490)	870(600)	1045(720)
TG-13	370(255)	485(335)	605(415)	825(570)	1035(715)	1310(900)	1670(1150)
TG-14	370(255)	485(335)	605(415)	825(570)	1035(715)	1310(900)	1670(1150)
TG-27	305(210)	415(285)	525(360)	735(505)	915(630)	1110(765)	1350(930)
TG-28	305(210)	415(285)	525(360)	735(505)	915(630)	1110(765)	1350(930)
TG-35	355(245)	470(325)	605(415)	860(590)	1075(740)	1375(945)	1790(1235)

* Measured in lb/in²(N/cm²)

6

FHT-1 Profile [in(mm)]



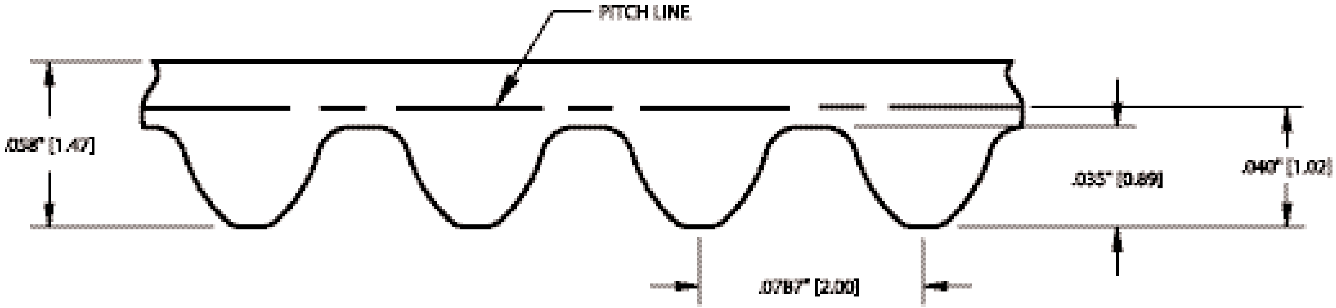
- **Standard Belt Widths:** .125" (3.2mm) .187" (4.7mm) .250" (6.4mm) .375" (9.5mm)
  Please contact factory for other width options.
- **Standard Reinforcements:** Kevlar® or Fiberglass @ 50 T.P.I
- **Standard Durometer:** 80 Shore A

Stock Size List*

No. of Teeth	Pitch Length Inch	Pitch Length mm	Length Tolerance Inch (mm)
125	4.92	125	+/- .020" (.51)
142	5.59	142	+/- .020" (.51)
145	5.71	145	+/- .020" (.51)
150	5.91	150	+/- .020" (.51)
160	6.30	160	+/- .020" (.51)
175	6.89	175	+/- .020" (.51)
185	7.28	185	+/- .020" (.51)
195	7.68	195	+/- .020" (.51)
200	7.87	200	+/- .020" (.51)
210	8.27	210	+/- .020" (.51)
225	8.86	225	+/- .020" (.51)
230	9.06	230	+/- .020" (.51)
240	9.45	240	+/- .020" (.51)
250	9.84	250	+/- .020" (.51)
255	10.04	255	+/- .030" (.76)
265	10.43	265	+/- .030" (.76)
270	10.63	270	+/- .030" (.76)
275	10.83	275	+/- .030" (.76)
280	11.02	280	+/- .030" (.76)
300	11.81	300	+/- .030" (.76)
310	12.20	310	+/- .030" (.76)
325	12.80	325	+/- .030" (.76)
350	13.78	350	+/- .030" (.76)
375	14.76	375	+/- .030" (.76)
400	15.75	400	+/- .030" (.76)
450	17.72	450	+/- .040" (1.02)
500	19.69	500	+/- .040" (1.02)
550	21.65	550	+/- .040" (1.02)
600	23.62	600	+/- .040" (1.02)

*** Please contact factory for sizes not listed.**

FHT-2 Profile [in(mm)]



- Standard Belt Widths: .125" (3.2mm) .187" (4.7mm) .250" (6.4mm) .375" (9.5mm)
  *Please contact factory for other width options.
- Standard Reinforcements: Kevlar®or Fiberglass @ 50 T.P.I
- Standard Durometer: 80 Shore A

Stock Size List*

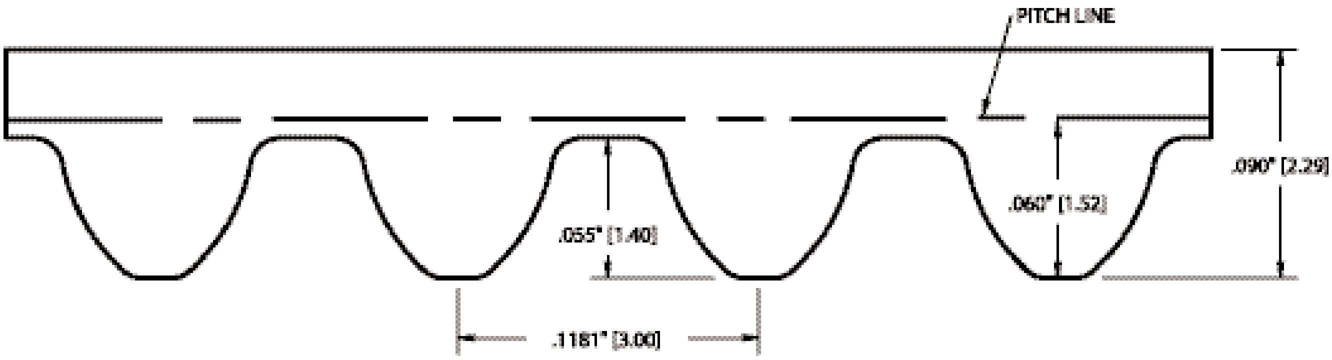
No. of Teeth	Pitch Length Inch	Pitch Length mm	Length Tolerance Inch	Length Tolerance mm
50	3.94	100	+/- .020"	(.51)
55	4.33	110	+/- .020"	(.51)
56	4.41	112	+/- .020"	(.51)
60	4.72	120	+/- .020"	(.51)
65	5.12	130	+/- .020"	(.51)
70	5.51	140	+/- .020"	(.51)
75	5.91	150	+/- .020"	(.51)
76	5.98	152	+/- .020"	(.51)
80	6.30	160	+/- .020"	(.51)
83	6.54	166	+/- .020"	(.51)
84	6.61	168	+/- .020"	(.51)
85	6.69	170	+/- .020"	(.51)
86	6.77	172	+/- .020"	(.51)
89	7.01	178	+/- .020"	(.51)
90	7.09	180	+/- .020"	(.51)
95	7.48	190	+/- .020"	(.51)
97	7.64	194	+/- .020"	(.51)
100	7.87	200	+/- .020"	(.51)
104	8.19	208	+/- .020"	(.51)
105	8.27	210	+/- .020"	(.51)
110	8.66	220	+/- .020"	(.51)
111	8.74	222	+/- .020"	(.51)
115	9.06	230	+/- .020"	(.51)
116	9.13	232	+/- .020"	(.51)
120	9.45	240	+/- .020"	(.51)
125	9.84	250	+/- .020"	(.51)
130	10.24	260	+/- .030"	(.76)
135	10.63	270	+/- .030"	(.76)
136	10.71	272	+/- .030"	(.76)
140	11.02	280	+/- .030"	(.76)
144	11.34	288	+/- .030"	(.76)
145	11.42	290	+/- .030"	(.76)

No. of Teeth	Pitch Length Inch	Pitch Length mm	Length Tolerance Inch	Length Tolerance mm
150	11.81	300	+/- .030"	(.76)
155	12.20	310	+/- .030"	(.76)
160	12.60	320	+/- .030"	(.76)
165	12.99	330	+/- .030"	(.76)
170	13.39	340	+/- .030"	(.76)
175	13.78	350	+/- .030"	(.76)
180	14.17	360	+/- .030"	(.76)
185	14.57	370	+/- .030"	(.76)
190	14.96	380	+/- .030"	(.76)
192	15.12	384	+/- .030"	(.76)
195	15.35	390	+/- .030"	(.76)
197	15.51	394	+/- .030"	(.76)
200	15.75	400	+/- .030"	(.76)
205	16.14	410	+/- .040"	(1.02)
210	16.54	420	+/- .040"	(1.02)
215	16.93	430	+/- .040"	(1.02)
220	17.32	440	+/- .040"	(1.02)
225	17.72	450	+/- .040"	(1.02)
230	18.11	460	+/- .040"	(1.02)
235	18.50	470	+/- .040"	(1.02)
240	18.90	480	+/- .040"	(1.02)
245	19.29	490	+/- .040"	(1.02)
250	19.69	500	+/- .040"	(1.02)
255	20.08	510	+/- .040"	(1.02)
260	20.47	520	+/- .040"	(1.02)
265	20.87	530	+/- .040"	(1.02)
270	21.26	540	+/- .040"	(1.02)
275	21.65	550	+/- .040"	(1.02)
280	22.05	560	+/- .040"	(1.02)
285	22.44	570	+/- .040"	(1.02)
290	22.83	580	+/- .040"	(1.02)
295	23.23	590	+/- .040"	(1.02)
300	23.62	600	+/- .040"	(1.02)

7

* Please contact factory for sizes not listed.

FHT-3 Profile [in(mm)]



- **Standard Belt Widths:** .125" (3.2mm) .187" (4.7mm) .250" (6.4mm) .375" (9.5mm)
  *Please contact factory for other width options.
- **Standard Reinforcements:** Kevlar® or Fiberglass @ 50 T.P.I.
- **Standard Durometer:** 80 Shore A

Stock Size List*

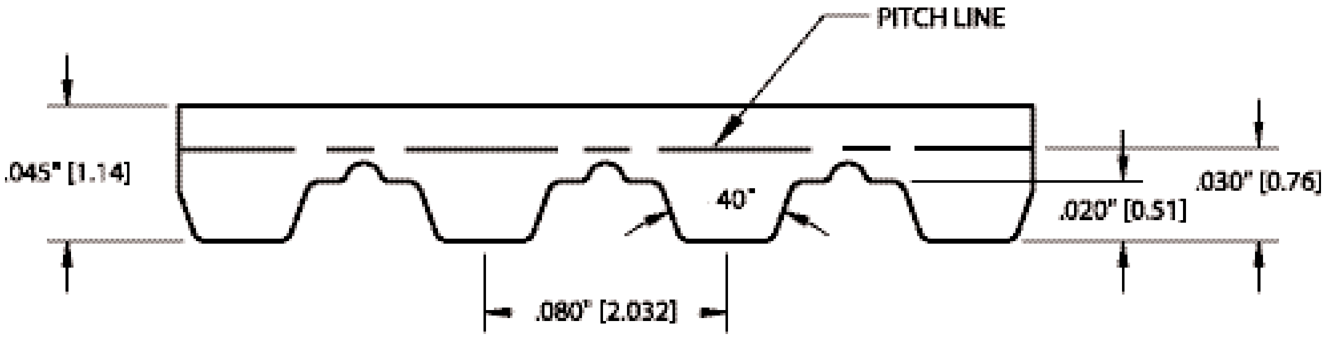
No. of Teeth	Pitch Length Inch	Pitch Length mm	Length Tolerance Inch	Length Tolerance mm
45	5.31	135	+/- .020"	(.51)
48	5.67	144	+/- .020"	(.51)
50	5.91	150	+/- .020"	(.51)
54	6.38	162	+/- .020"	(.51)
55	6.50	165	+/- .020"	(.51)
58	6.85	174	+/- .020"	(.51)
60	7.09	180	+/- .020"	(.51)
62	7.32	186	+/- .020"	(.51)
64	7.56	192	+/- .020"	(.51)
65	7.68	195	+/- .020"	(.51)
67	7.91	201	+/- .020"	(.51)
69	8.15	207	+/- .020"	(.51)
70	8.27	210	+/- .020"	(.51)
72	8.50	216	+/- .020"	(.51)
74	8.74	222	+/- .020"	(.51)
75	8.86	225	+/- .020"	(.51)
77	9.09	231	+/- .020"	(.51)
78	9.21	234	+/- .020"	(.51)
80	9.45	240	+/- .020"	(.51)
81	9.57	243	+/- .020"	(.51)
83	9.80	249	+/- .020"	(.51)
85	10.04	255	+/- .030"	(.76)
88	10.39	264	+/- .030"	(.76)
90	10.63	270	+/- .030"	(.76)
92	10.87	276	+/- .030"	(.76)
95	11.22	285	+/- .030"	(.76)
98	11.57	294	+/- .030"	(.76)
100	11.81	300	+/- .030"	(.76)
102	12.05	306	+/- .030"	(.76)
105	12.40	315	+/- .030"	(.76)
108	12.76	324	+/- .030"	(.76)
110	12.99	330	+/- .030"	(.76)

No. of Teeth	Pitch Length Inch	Pitch Length mm	Length Tolerance Inch	Length Tolerance mm
112	13.23	336	+/- .030"	(.76)
115	13.58	345	+/- .030"	(.76)
118	13.94	354	+/- .030"	(.76)
120	14.17	360	+/- .030"	(.76)
122	14.41	366	+/- .030"	(.76)
125	14.76	375	+/- .030"	(.76)
126	14.88	378	+/- .030"	(.76)
128	15.12	384	+/- .030"	(.76)
130	15.35	390	+/- .030"	(.76)
135	15.94	405	+/- .030"	(.76)
137	16.18	411	+/- .040"	(1.02)
140	16.54	420	+/- .040"	(1.02)
143	16.89	429	+/- .040"	(1.02)
145	17.13	435	+/- .040"	(1.02)
148	17.48	444	+/- .040"	(1.02)
150	17.72	450	+/- .040"	(1.02)
151	17.83	453	+/- .040"	(1.02)
155	18.31	465	+/- .040"	(1.02)
158	18.66	474	+/- .040"	(1.02)
160	18.90	480	+/- .040"	(1.02)
161	19.02	483	+/- .040"	(1.02)
165	19.49	495	+/- .040"	(1.02)
167	19.72	501	+/- .040"	(1.02)
170	20.08	510	+/- .040"	(1.02)
175	20.67	525	+/- .040"	(1.02)
179	21.14	537	+/- .040"	(1.02)
180	21.26	540	+/- .040"	(1.02)
183	21.61	549	+/- .040"	(1.02)
185	21.85	555	+/- .040"	(1.02)
190	22.44	570	+/- .040"	(1.02)
195	23.03	585	+/- .040"	(1.02)
200	23.62	600	+/- .040"	(1.02)

7

* Please contact factory for sizes not listed.

MXL Profile [in(mm)]



- Standard Belt Widths: .125" (3.2mm) .187" (4.7mm) .250" (6.4mm) .375" (9.5mm)
  *Please contact factory for other width options.
- Standard Reinforcements: Kevlar® or Fiberglass @ 50 T.P.I.
- Standard Durometer: 80 Shore A

Stock Size List*

No. of Teeth	Pitch Length Inch	Pitch Length mm	Length Tolerance Inch (mm)
45	3.60	91.44	+/- .020" (.51)
48	3.84	97.54	+/- .020" (.51)
50	4.00	101.60	+/- .020" (.51)
55	4.40	111.76	+/- .020" (.51)
56	4.48	113.79	+/- .020" (.51)
60	4.80	121.92	+/- .020" (.51)
65	5.20	132.08	+/- .020" (.51)
68	5.44	138.18	+/- .020" (.51)
70	5.60	142.24	+/- .020" (.51)
75	6.00	152.40	+/- .020" (.51)
76	6.08	154.43	+/- .020" (.51)
80	6.40	162.56	+/- .020" (.51)
83	6.64	168.66	+/- .020" (.51)
85	6.80	172.72	+/- .020" (.51)
87	6.96	176.78	+/- .020" (.51)
90	7.20	182.88	+/- .020" (.51)
91	7.28	184.91	+/- .020" (.51)
93	7.44	188.98	+/- .020" (.51)
95	7.60	193.04	+/- .020" (.51)
97	7.76	197.10	+/- .020" (.51)
100	8.00	203.20	+/- .020" (.51)
102	8.16	207.26	+/- .020" (.51)
103	8.24	209.30	+/- .020" (.51)
106	8.48	215.39	+/- .020" (.51)
105	8.40	213.36	+/- .020" (.51)
110	8.80	223.52	+/- .020" (.51)
112	8.96	227.58	+/- .020" (.51)
115	9.20	233.68	+/- .020" (.51)
120	9.60	243.84	+/- .020" (.51)
123	9.84	249.94	+/- .020" (.51)
125	10.00	254.00	+/- .030" (.76)
130	10.40	264.16	+/- .030" (.76)
135	10.80	274.32	+/- .030" (.76)
140	11.20	284.48	+/- .030" (.76)
145	11.60	294.64	+/- .030" (.76)
150	12.00	304.80	+/- .030" (.76)
153	12.24	310.90	+/- .030" (.76)
155	12.40	314.96	+/- .030" (.76)

No. of Teeth	Pitch Length Inch	Pitch Length mm	Length Tolerance Inch (mm)
157	12.56	319.02	+/- .030" (.76)
158	12.64	321.06	+/- .030" (.76)
160	12.80	325.12	+/- .030" (.76)
162	12.96	329.18	+/- .030" (.76)
165	13.20	335.28	+/- .030" (.76)
170	13.60	345.44	+/- .030" (.76)
175	14.00	355.60	+/- .030" (.76)
180	14.40	365.76	+/- .030" (.76)
185	14.80	375.92	+/- .030" (.76)
190	15.20	386.08	+/- .030" (.76)
195	15.60	396.24	+/- .030" (.76)
200	16.00	406.40	+/- .040" (1.02)
205	16.40	416.56	+/- .040" (1.02)
210	16.80	426.72	+/- .040" (1.02)
215	17.20	436.88	+/- .040" (1.02)
220	17.60	447.04	+/- .040" (1.02)
225	18.00	457.20	+/- .040" (1.02)
230	18.40	467.36	+/- .040" (1.02)
235	18.80	477.52	+/- .040" (1.02)
240	19.20	487.68	+/- .040" (1.02)
245	19.60	497.84	+/- .040" (1.02)
250	20.00	508.00	+/- .040" (1.02)
251	20.08	510.03	+/- .040" (1.02)
255	20.40	518.16	+/- .040" (1.02)
260	20.80	528.32	+/- .040" (1.02)
265	21.20	538.48	+/- .040" (1.02)
270	21.60	548.64	+/- .040" (1.02)
275	22.00	558.80	+/- .040" (1.02)
280	22.40	568.96	+/- .040" (1.02)
285	22.80	579.12	+/- .040" (1.02)
290	23.20	589.28	+/- .040" (1.02)
295	23.60	599.44	+/- .040" (1.02)
300	24.00	609.60	+/- .040" (1.02)
305	24.40	619.76	+/- .040" (1.02)
310	24.80	629.92	+/- .040" (1.02)
315	25.20	640.08	+/- .040" (1.02)
320	25.60	650.24	+/- .040" (1.02)
325	26.00	660.40	+/- .040" (1.02)
330	26.40	670.56	+/- .040" (1.02)

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*** Please contact factory for sizes not listed.**

Urethane and Reinforcement Chemical Resistance

Provided below is a general guide for the exposure of Fenner Precision materials to a wide range of chemicals. We emphasize that this is only a guide. All other requirements for satisfactory performance must be considered (such as operational temperature ranges, aeration, exposure time, and other pertinent factors).

Key

- **A** - Little or no effect.
- **B** - Minor to moderate effect.
- **C** - Severe effect to complete destruction.
- **T** - Test before using. No data, but most likely to be satisfactory.
- **X** - No data but most likely to be unsatisfactory.
- **N** - No data available.

Chemical	Concentration	Polyurethane	Kevlar®	Glass*	Polyester
Acetamide	100%	N	N	T	B
Acetic acid	40%	B	A	T	A
Acetone	100%	C	A	T	A
Ammonia, anhydrous	-	T	N	T	N
Ammonium chloride solutions	-	T	N	T	N
Ammonium hydroxide	28%	A	A	T	N
Ammonium sulfate solutions	-	T	N	T	N
Amyl acetate	100%	C	N	T	A
Amyl alcohol	100%	T	A	T	A
ASTM hydrocarbon test fluid	-	T	N	T	N
ASTM oil #1	-	A	N	T	N
ASTM oil #3	-	B	N	T	N
Benzaldehyde	100%	N	A	T	A
Benzene	100%	C	A	T	B
Benzoyl chloride	100%	T	N	T	A
Benzyl alcohol	100%	N	N	T	A
Borax solutions	-	A	N	T	N
Brake fluid	100%	N	B	T	N
Butane	-	A	N	T	N
Butyl acetate	-	C	N	T	N
Butyl aldehyde	-	T	N	T	N
Calcium bisulfate solutions	-	A	N	T	N
Calcium chloride solutions	-	T	N	T	N
Calcium hydroxide solutions	-	A	N	T	N
Carbon bisulfide	-	T	N	T	N
Carbon monoxide	-	A	N	T	N
Castor oil	-	A	N	T	N
Chlorobenzene	100%	X	N	T	A
Chloroform	100%	C	N	T	A
Cottonseed oil	100%	A	A	T	A
Dibutyl phthalate	-	B	N	T	N
Dimethyl acetamide	100%	N	N	T	A
Dimethyl formamide	100%	N	N	T	C
Ethyl acetate	100%	C	N	T	A
Ethyl alcohol	100%	B	A	T	A
Ethyl chloride	-	C	N	T	N
Ethyl ether	100%	N	A	T	N
Ethylene glycol/water	50/50	B	B	T	A
Ethylene dichloride	-	C	N	T	N
Ferric chloride	3%	T	B	T	N
Formaldehyde in water	10%	X	A	T	A
Formic acid	90%	X	C	T	A
Fuel oil	100%	B	N	T	A

* Fiberglass is generally inert when exposed to most chemicals. Hydrofluoric Acid is the main exception.

Chemical	Concentration	Polyurethane	Kevlar	Glass*	Polyester
Glycerol	100%	N	N	T	A
Hydraulic oils	-	B	N	T	N
Hydrochloric acid	10%	B	C	T	N
Hydrofluoric Acid	-	C	A	C	C
Hydrogen	-	A	N	T	N
Isooctane	-	B	N	T	N
Isopropyl alcohol	-	C	N	T	N
Kerosene	100%	C	N	T	A
Lard	100%	N	A	T	A
Linseed oil	100%	B	A	T	A
Lubricating oils	-	B	N	T	N
m-Xylene	100%	N	N	T	A
Magnesium hydroxide	-	A	N	T	N
Methyl alcohol	100%	C	A	T	A
Methylethyl ketone	100%	C	N	T	A
Methylene chloride	100%	C	N	T	A
Mineral oil	100%	A	A	T	A
n-Butyl alcohol	100%	N	N	T	A
n-Hexane	-	B	N	T	N
Naphthalene	100%	B	N	T	A
Nitric acid	10%	C	B	T	N
o-Phenylphenol	100%	N	N	T	A
Oleic acid	100%	B	N	T	A
p-Dichlorobenzene	100%	N	N	T	A
Palmitic acid	-	A	N	T	N
Phenol	100%	C	N	T	C
Phenol in water	5%	N	A	T	N
Phosphoric	10%	T	B	T	N
Pine oil	100%	N	N	T	A
Potassium hydroxide	-	A	N	T	N
Propylene carbonate	100%	N	N	T	A
Pyridine	100%	N	N	T	A
Resorcinol	100%	N	A	T	A
SAE #10 oil	-	A	N	T	N
Salicylic	3%	N	A	T	N
Soap solutions	-	A	N	T	N
Sodium carbonate	1%	N	N	T	N
Sodium chloride	10%	N	B	T	N
Sodium hydroxide	10%	A	C	T	N
Sodium hypochlorite	0.4%	X	N	T	N
Sodium phosphate	5%	N	B	T	N
Soybean oil	-	B	N	T	N
Stearic acid	-	A	N	T	N
Stoddard solvent	100%	N	N	T	A
Sulfuric	70%	C	B	T	N
Tannic acid	10%	N	N	T	A
Tartaric acid	-	A	N	T	N
Toluene	-	C	N	T	N
Turpentine	100%	C	N	T	A
Water, tap	100%	A	A	T	N
Xylene	100%	C	N	T	N

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* Fiberglass is generally inert when exposed to most chemicals. Hydrofluoric Acid is the main exception.

Glossary Of Polyurethane Belting Terms

ABRASION RESISTANCE Ability of polyurethane to withstand mechanical action (such as rubbing, scraping, etc.)

ADDITIVES Materials combined with prepolymer and curative to modify the properties of the urethane. Examples are plasticizers, fillers, and stabilizers.

BACKING THICKNESS The distance from the cord support (in flighted belts) or the tooth root (no flight belts) to the backside of the belt.

BASHORE RESILIENCE An ASTM test for the rebound characteristics of the elastomer. High bashore resilience generally implies low heat buildup in the urethane when used at high speeds under loads.

CATALYST The ingredient in polyurethane which initiates a chemical reaction or increases the rate of chemical reaction.

COEFFICIENT OF FRICTION (COF) The ratio of the force required to move an object across a surface to the weight of the object.

COLORANTS Dyes or pigments that provide color to polyurethane.

COMPRESSION SET The characteristic of an elastomer to return to its original state after deforming forces are removed.

CREEP Slow continued growth or lengthening of a material under a constant load.

DENIER The weight in grams per 9,000 meters of a particular reinforcement.

DENSITY Weight per unit volume of a substance.

DRIVEN PULLEY The load-bearing pulley in the system that is directly powered by the belt.

DRIVER PULLEY The pulley in the system that supplies power directly to the belt.

DUROMETER The hardness of the final elastomer, or the gauge used to measure hardness.

ELASTIC LIMIT The maximum stress to which a test specimen may be subjected and still return to its original length upon release of the load.

ELASTICITY The property whereby a solid material changes its shape and size under the action of opposing forces, but recovers its original configurations when the forces are removed.

ELASTOMER A natural or synthetic material which exhibits rubber-like properties of high flexibility.

ENDOTHERM Heat absorbed in a chemical reaction.

EXOTHERM Heat given off in a chemical reaction.

HYSTERESIS A loss of energy due to successive deformation and relaxation.

MODULUS The slope of the line on a stress-strain curve. The slope is the ratio of stress to strain.

POLYESTER A chemical building block (DIOL) reacted with diisocyanate to produce prepolymers. The polyester provides good solvent resistance and good mechanical properties in the final elastomer.

POLYETHER A chemical building block (DIOL) used in place of polyester in some prepolymers. The polyether provides outstanding resilience and hydrolytic stability.

POLYMER A material, of either synthetic or natural origin, made of many repeating molecules.

POLYURETHANE (URETHANE ELASTOMER) A synthetic rubber made by reacting diisocyanate with polyhydroxy-terminated compounds.

PREPOLYMER The liquid that is reacted with curative to form the final polyurethane polymer.

PULLEY RUNOUT The total deviation of a surface when rotated about an axis.

RMA Rubber Manufacturers Association

SLIP Occurs when the torque load in the system exceeds the frictional force provided by tension in a flat belt or Fenatrak belt.

STRAIN The elongation of a specimen under load measured as a percentage of the original length.

STRESS The load per unit of original cross-sectional area.

SYNCHRONOUS DRIVE A power transmission mechanism with zero slip between the input and output.

SYNTHETIC Not of natural origin; prepared or made artificially; "man-made."

TDI (TOLUENE DIISOCYANATE OR TOLYENE DIISOCYANATE) A chemical building block reacted in excess with polyester or polyether to produce prepolymers.

TEAR RESISTANCE Opposition of a material to a force acting to initiate and then propagate a failure at the edge of a test specimen.

TEAR STRENGTH (SPLIT STRENGTH) A measure of tear resistance.

TENACITY Break strength per unit of linear density.

TENSILE STRENGTH The maximum tensile stress sustained by the specimen before failure in a tensile test.

TENSION A force tending to produce elongation or extension.

THERMOPLASTIC A urethane which can be repeatedly softened or melted and which will harden to a new shape when cooled.

THERMOSET A urethane which cures using heat (or catalyst). The material is chemically cross-linked and cannot be reprocessed. Thermosets, unlike thermoplastics, can be used at elevated temperatures.

TOTAL INDICATOR READING (T.I.R.) The value derived (high to low reading) by a dial indicator.

VISCOSITY Measure of the torque produced on a constant-speed, rotating spindle, in a liquid medium. Usually designated in centipoise.

YIELD POINT A point on the stress-strain curve at which there is a sudden increase in strain without a corresponding increase in stress.

Precision Belt Application Data Sheet

Customer Data

Company:	Date:		
Contact:	E-mail:		
Address:	City:	State:	Zip:
Telephone No:	Fax No:		

Description

Product or Project Name:			
Belt Description (Length, Width, Pitch, etc.):			
Quantities Required Per Month:			
Peak Per Month:	Qty. Per Year:		
Target Price Requirement (per belt):			
Tooling Quote Required? ☐ Yes ☐ No			
Are you providing drawings of the:			
Drive? ☐ Yes ☐ No	Belt? ☐ Yes ☐ No	Pulley? ☐ Yes ☐ No	

Drive Data

Pulleys (type, pitch, no. grooves, material, face width):	
DriveR:	DriveN:
Idler(s):	
Belt (if replacing existing belt, provide length, width, pitch, body material, tension cord material):	
Drive Mechanics — Fixed Center: ☐ Yes ☐ No	
If yes, what is the center distance dimension and tolerance (In./mm.)?	
Installed end load fixed or floating (lbs./Newtons)?	
Maximum speed of driver (RPM):	
Starting Torque (oz.-In./N-cm.):	
Running Torque (oz.-In./N-cm.):	

* Please complete all information and fax to Fenner Precision at 717-664-8287.
Or visit our website at www.fennerprecision.com and e-mail the information.

Precision Belt Application Data Sheet

Maximum Torque (oz.-In./N.-cm.):		
Weight Being Moved (lbs./Newtons):		
Drive Ratio:	☐ Exact	☐ Approximate
Ambient Temperature (°F/°C):		
Non-Standard Atmospheric Conditions:	☐ Oil ☐ Dust ☐ Fumes	
	☐ Others:	
Reciprocating Drive:	☐ Yes	☐ No
If yes, what is the frequency of reversal?		
Shock Loading:	☐ Yes	☐ No
If yes, what is the shock load in lbs./Newtons?		
Description of Application:		

Custom Features

Food Handling: ☐ Yes ☐ No	FDA Req'd ☐ Yes ☐ No Grade: ☐ Wet ☐ Dry
Dual Durometer Req'd: ☐ Yes ☐ No	Shore A Hardness Inside: Backside:
Additional Backing Thickness: ☐ Yes ☐ No	Thickness Required:
Other Requirements such as Through Holes, Guide Ribs, Slots, Channels, Lugs, Fins, Etc. List & Describe:	
If Conveying or Packaging Application: What Material is being Conveyed?	
Coefficient of Friction Required Between Belt and Conveyed Material?	

Sketch of Drive

* Please complete all information and fax to Fenner Precision at 717-664-8287.
Or visit our website at www.fennerprecision.com and e-mail the information.

www.fennerprecision.com

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TEL: 800.327.2288
717.665.2421
FAX: 717.664.8287
EMAIL: belts@fennerdrives.com

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FAX: 630.584.8589
EMAIL: ericsmith@fennerdrives.com

North Carolina Sales Office
8045 Reunion Road
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FAX: 910.681.3805
EMAIL: jerryscrocco@fennerdrives.com

United Kingdom Sales Office
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Lincoln, Great Britain LN67AF
TEL: 011.717.664.8269
FAX: 011.717.664.8287
EMAIL: tonywatts@fennerdrives.com

Singapore Sales Office
112 East Coast Road
#03-34 Singapore 428802
TEL: 65.6.345.7223
FAX: 65.6.345.6909
EMAIL: kpchia@fennerdrives.com

China Sales Office
445 Waiqian Gong Lu Jiading,
Shanghai 201823 China
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